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SOME VIEWS ON THE PROBLEMS OF FRUIT GROWING

B. OWEN FRENCH

If by "problems" we mean the absence of knowledge, it is apparent that the field of discussions and enquiry is infinitely large. However, the introduction of economic considerations provides a tool by which it is possible to make a selection based on a scale of importance and this enquiry is concerned with certain problems of production which are of major economic significance to the fruit industry.

A full understanding of the production problems of a crop requires an appreciation of those features of the crop plant which are significant determinants of production technique. For fruit crops these are:—

A. the plant is nearly always a perennial and usually a woody perennial;

B. the plant is usually heterozygous;

C. the plant is usually long-lived, requiring a number of years to come to full production and occupying the land for a considerable period;

D. there are usually relatively few plants to the acre;

E. the harvested product is usually highly perishable.

The influence of these factors will be evident at various points in the following discussion.

The Problem of Quality

For the individual fruit grower, an improvement in the quality of fruit produced will usually result in an increase in market returns. The same is not true for the industry as a whole, and an overall increase in price will

follow only if the overall improvement in quality stimulates demand.

It is therefore of some importance to enquire as to which quality attributes are most important in the markets and which attributes will stimulate demand. There is a need for detailed knowledge of consumer preferences in this regard. It might be argued that prices paid at the wholesale market express consumer preference. However, this is not so because price is a reflection of many things besides the preference of the consumer, and involves such things as the preference of the middleman for a fruit which may display well or store well, and the relative availability of other fruit kinds or of the same fruit with different quality attributes. In any case, if we are to seek to increase total fruit consumption, or to increase consumption of a particular kind, it is surely a first step to provide a fruit which is attractive to the consumer.

It is in the field of quality that the highly perishable nature of the product becomes of major significance. Fruit tends to deteriorate immediately it is harvested. If fruit is to attract it is important that it should look "fresh." The mechanics of getting "fresh" looking fruit to the consumer require a study of all steps in the "handling" and distribution process.

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This article is based on an address to the New South Wales Branch.

It is not easy to define what is most attractive to the consumer. For instance, some groups of consumers may prefer green coloured apples, other striped apples and others full red apples; some prefer tart apples, others sweet, some prefer mandarins, others oranges; some prefer blood oranges and so on.

Once the nature of consumer preferences and the market have been defined, the next step is to adjust cultural techniques to gain quality control. However, in the present state of knowledge, this is not possible.

French (1958) reviewed the present position regarding research into the influence of tree nutrition on fruit quality and concluded that the problem had received little study in Australia and that research was needed to:—

- A. define the characteristics of quality for each kind of fruit in each field of utilisation;
- B. determine scales of consumer preference for such characteristics;
- C. evolve simple and objective measurements for quality characteristics;
- D. determine the influence of field production techniques on quality.

The Problem of Yield

Yields per bearing acre achieved in the Australian fruit industry are generally comparable with world standards. Average yields for 1958/59 are set out in Table 1.

TABLE 1

Yields of Fruit Crops In Australia 1958/59.

Crop	Yield per Acre in Bushels.
Apples	199
Navel Oranges	180
Valencia Oranges	142
Apricots	151
Peaches	182
Pears	266
Bananas	178

French (1960) reviewed world production trends in canning fruits and demonstrated that Australian yields were generally in keeping with or somewhat better than those obtained by countries exporting to the same markets. One outstanding exception was the average yield of clingstone peaches which in California

varied between 9 and 12 long tons per acre, whereas the Australian yield varied between 4 and 7.5 long tons.

Although the average yield of Navel oranges is approximately 180 bushels and that of Valencia oranges 150 bushels per acre, individual farm yields as high as 2,000 bushels per bearing acre or about 10 times the average are frequently observed. A similar situation is evident with most other fruits and we might assume a very skewed frequency distribution and postulate an opportunity for a considerable increase in average yields.

It is reasonable to assume that incomes closely follow yields and that there is a wide variability with a low average. The Water Conservation and Irrigation Commission (1958) reports that the average gross return for 920 horticultural farms on the Murrumbidgee Irrigation Areas in 1957/58 was only £2,853 per farm. The average area of crops irrigated was 20 acres per farm and yields would be somewhat greater than for Australia as a whole.

Each phase of production technique (tillage, irrigation, fertiliser, pruning, and so on) becomes limiting at some low level of application, and to this extent they may be regarded as of equal significance. However, the extent to which each phase can influence yield above this limiting level is much less certain.

Balaam (personal communication) using data from Corbin (1959) relating to a survey of factors affecting canning peach yields on the Murrumbidgee Irrigation Areas states that about 30% of the variation in yields was due to soil variation.

Hoos and Phelps (1948) report that California peach yields averaged 6.4 short tons per bearing acre for the period 1930-34 but that thereafter a gradual increase occurred to 9.5 tons for 1940-44 and to 11.5 tons in 1946. This change was concurrent with a relocation of the industry in more favourable inland valleys, but improved cultural care was also considered to be an important factor. The trends recognised by Hoos and Phelps have been confirmed by later statistics (French, 1960).

In view of variability in yield, it is pertinent to enquire whether fruit production is located in the most suitable districts available. Unless a district has a potential for high yields, or high net returns due to a special advantage such as earliness, investigations relating to other cultural practices are little more than palliatives.

The location of large sections of the fruit industry has been determined by many factors other than maximum suitability for crop production. These factors include proximity to markets, availability of water for irrigation, cheap land and the administrative considerations involved in land settlement policies. Fruit growing has thus frequently become established in areas of less than maximum suitability. However, once there has been an investment of capital and human ambitions, the established pattern changes slowly, and particularly so when the change required is to a less extensive form of land use. Nevertheless, if there are significant areas of production which do not represent a long term stable land use, it may be best for the individuals concerned, and for the community, to face up to the problems of early relocation, rather than wait for the attrition of capital and human hopes.

Before undertaking such a drastic step, it would be necessary first to accurately assess the productive potential of the district in question.

The Problem of Climate

Climate is undoubtedly a major determinant of potential productivity. However, it is probable that its influence on the location of Australia's fruit industries has been largely confined to determining the limits of development through the onset of such extremes as frost and water deficit.

Barnard (1946) compared the heat indices of some Australian citrus growing districts with those of the main overseas areas. He concluded that for the production of grapefruit, the Australian districts fall short of the average overseas by about 3,000 to 4,000 day degrees above 55 degrees F. It is of some interest to consider whether the failure to develop a grapefruit habit in Australia is not related to this fact. Certainly there is room for more

critical phenological investigation along these and similar lines for all fruits.

The availability of soil moisture obviously sets a limit to the expansion of fruit production under rainfall conditions. However, its effect on yield and quality of fruit under conditions where tree growth can be satisfactorily maintained is not so readily assessed. A single weather occurrence may be as important as the average climate in determining suitability. Thus wet conditions which occur about once every 6 or 7 years on the Murrumbidgee Irrigation Areas, have limited orchard productivity through waterlogging and flooding. In this instance, additional capital expenditure in subsurface drainage is expected to bring improvement.

The Problem of Soil

In fruit growing, it is generally recognised that soil physical conditions are much more important than chemical conditions or nutrient levels: and of the soil physical conditions, porosity as it affects drainage and aeration, is most significant. (Gardner et al 1939).

Howard and McIntyre (1943), reporting on a survey of Murrumbidgee Irrigation Areas orchards, concluded that citrus is rather susceptible in its edaphic environment and that the spread and health of citrus trees was greatest on permeable soils with a deep surface and a subsoil of clay loam to sandy clay loam. Peaches, prunes, apricots and vines were not so susceptible to soil differences but were generally similar to citrus.

Generally speaking, deeply pervious soils are considered to be best for fruit growing and sands are thus frequently regarded as being the most suitable soil types. This is particularly so for Australian irrigation conditions (see I. R. & E. C. undated, Northcote and Boehm, 1949), and post-war irrigation land settlement schemes at Loxton in South Australia, Robinvale in Victoria and Coomealla in New South Wales have utilised such soils almost entirely.

Sands are not usually highly regarded for field crops or pastures and it appears that there is a basic difference in the physiology of the fruit tree in relation to soil and that considerable practical benefit could follow

from a better understanding of the relationship.

While free drainage is a generally accepted requisite of a good fruit growing soil, knowledge of the relationship is virtually confined to its limiting effects at the margin where tree health is obviously impaired. Further study of the factors influencing and causing tree decline is needed and investigations should be extended to determine the relationships between yield and the degree of drainage. The factors which are probably important are the frequency and duration of saturation and the season of the year at which the conditions occur.

Investigations along these lines probably offer the best chance for an improvement in the potential of many districts with adequate rainfall but with consistently low production.

The Problem of Soil Management and Land Use

Fruit crops usually occupy the land for many years and under most conditions, the maintenance of soil fertility is a major problem. Where the nature of the crop and climate permit the maintenance of a permanent pasture sod in the orchard, chemical and physical fertility are probably adequately maintained and perhaps improved. However, summer cultivation is necessary in most areas, particularly under irrigation conditions. In these circumstances, some decline in chemical fertility seems inevitable and where soils are structured, some decline in physical fertility will occur.

The extent of this decline and its effect on yield and quality are not known. Investigations of alternative systems of soil management have been undertaken with citrus on the Murrumbidgee Irrigation Areas (Frith 1952, Bouma 1958, Groenewegen and Bouma 1960) and with peaches in the Goulburn Valley (Anon 1956). However, as this problem is fundamental to permanent horticultural development, it is apparent that much more study is required to establish best soil management practices in each district.

When old fruit growing land is replanted to the same, or to a related crop, the replant trees rarely grow as well as the originals. The difference in tree response is frequently much greater than can be adequately explained by a

low level of chemical or physical fertility. Under some circumstances the poor growth of replants may be explained by disease and in other cases the cause is unknown.

There is a strong possibility that nematodes are important, at least in some areas and for some crops. While the production of a low cost nematicide may offer a ready means of overcoming the replant problem in such cases, the most rewarding field of work on the replant problem may well be in soil microecology. Soil fumigation holds some promise as a means of ameliorating, if not overcoming, the replant problem. However, it is costly and the long term effects have yet to be determined. The most obvious alternative is to undertake some soil building process. This has been estimated to take 5 years under pasture for the Murrumbidgee Irrigation Areas (I.R. & E.C. undated). However, such a programme has serious problems. French (1948) demonstrated, that depending upon the expected life of a planting and the time required for soil conditioning and for development of the young trees to bearing age, a productive area of 20 acres would require a total plantable area of from 27 to 57 acres.

The land use pattern of the agricultural industries is becoming increasingly stabilised and fruit growing has become concentrated in certain recognised districts where it is confined to specialised farms of relatively small area. If production is to be maintained in these areas, it is apparent that the land must be maintained in some form of permanent rotation and a solution to these problems is urgent (Harper 1958).

Pest and Disease Control

Post-war developments in the agricultural chemical industry have provided adequate controls for most of the important insect and fungal diseases.

However, chemical control of fungal diseases attacking the roots of plants continues to present difficulties. Control of citrus root-rot (*Phytophthora citrophthora*) has been achieved through the use of the resistant root-stock *Poncirus trifoliata*, but root rots caused by *Phytophthora cinnamomi* are a major

problem in deciduous fruit trees and particularly in Avocados where it is limiting the development of an industry.

Control of bacterial diseases remains difficult. Bacterial canker (*Pseudomonas syringae*) and bacterial spot (*Xanthomonas pruni*) cause considerable losses in stone fruits. Crown gall (*Agrobacterium tumefaciens*) results in considerable losses of young trees in fruit tree nurseries. Pear blast (*Pseudomonas syringae*) and walnut blight (*Xanthomonas juglandis*) are other important bacterial diseases for which satisfactory economic control has yet to be achieved.

Most fruit trees, being heterozygous, are propagated vegetatively so that the spread of virus infection is a constant danger. However, the importance of these diseases to the fruit industry has only been fully realised during recent years. Fraser (1955) reported a considerable increase in the number of recorded virus diseases of citrus between 1949 and 1955 and Crowley (1955) reported similarly for stone fruits. It is unlikely that the observations made between 1944 and 1955 related to new infections of the clonal lines and thus it seems safe to assume that virus diseases have have taken a much more serious toll of productive capacity than has been previously recognised.

Good progress has been made in the control of certain virus diseases of citrus and bananas, but there is a need for a considerably expanded programme in these and all other fruit crops, with the object of ascertaining the present distribution of virus diseases and of establishing virus free lines of all important clones.

The importance of nematodes in the replant problem has been mentioned previously and they are undoubtedly adversely affecting productive capacity in many mature plantings. However, except in a few specialised instances, there is virtually no knowledge regarding distribution or the extent of damage caused. The 1955 Plant Disease Conference recommended "that a centre be established at the Waite Agricultural Research Institute to provide training in the science of nematology, and that the work in this field in all States be extended."

Despite some progress in a few specialised fields, such as bananas, the need for further work in the fruit industry is as important today as it was in 1955.

Planting Distance and Tree Size

In its simplest form, yield per acre is a function of the number of plants and the production per plant. In fruit growing, the number of individual plants per acre is usually small — most fruit trees being planted at rates between 90 and 110 trees per acre. The productivity of the individual tree is thus of considerable significance and a small proportion of poor trees will seriously and adversely affect yield. On the other hand, a small increase in the number of trees may significantly improve yield.

As trees commence bearing while they are still relatively small, and as some years elapse before they reach maximum size and full production, fruitgrowers, especially citrus growers, have experimented with double planting in the rows. It is apparent that as the trees develop and grow they enter into increasingly severe competition with each other. At some stage, double planted trees will require different management practice from those planted at conventional spacings. Some major adjustment to fertiliser, irrigation and pruning practice as well as to pest and disease control, would probably be required and the intervening trees may need to be removed or treated in some way. Unfortunately, there are no citrical data upon which local practice can be formulated.

Conventional planting distances have been determined very largely by consideration of tree size. However, the possibilities of increasing yield per acre by reducing the size of the tree and increasing the density of planting require investigation. Satisfactory control of tree size can be achieved in some fruits by the use of rootstocks but research might evolve other practicable methods.

Large trees involve greatly increased costs in harvesting, pruning, thinning and spraying because the use of orchard ladders slows down operations. It is debatable whether the increased productivity of such trees offsets the additional costs, and whether a higher density of smaller trees would not result in higher net returns.

The Rootstock Problem

Generally satisfactory rootstocks are available for all major commercial fruit kinds. However, the problems of replanting old fruit growing land, damage from waterlogging, and attack from soil born fungus diseases such as *Phytophthora cinnamomi* and nematodes are problems which may be solved by rootstock investigations.

There is available a wide selection of clonal lines of apple rootstocks from East Malling and Long Ashton which provide a wide range of tree vigour; however, these require thorough testing and comparison at their optimum planting distance. Similar investigations should be undertaken with other fruit crops.

The Variety Problem

For the major fruit kinds at least, there is a range of varieties reasonably suited to existing markets. However, there are a few instances where there are special varietal problems. French and Vincent (1948) reported that the canning peach industry of the Murrumbidgee Irrigation Areas urgently required early varieties with satisfactory agronomic and processing qualities to extend the processing season. Some progress towards this end has been made by the introduction of certain new varieties. However, even better varieties are required.

The very wide range in the quality characteristics between acceptable varieties of one fruit kind is of considerable interest. It is exemplified by the marked differences in the expression of quality attributes of the Granny Smith apple as compared with the Delicious and of the Elberta peach as compared with the Shanghai.

The rational development of plantings and the selection of varieties require an understanding of the bases of consumer preferences and the reasons why fruits with such divergent attributes meet with such a consistent demand.

While pests and disease are generally satisfactorily controlled, it is apparent that resistant varieties would result in a considerable improvement in the economy of production. Significant advances would be achieved by the selection of varieties resistant to the following:—

Black Spot of Apple (*Venturia inaequalis*), Black Spot of Pears (*Venturia pyrina*), Powdery Mildew of Apple (*Podosphaera leucotricha*), Black Spot of Orange (*Guignardia citricarpa*), Brown Rot of Stone Fruits (*Sclerotinia fructicola*), Black Heart of Stone Fruits (*Verticillium dahliae*), Bacterial Canker of Apricots (*Pseudomonas syringae*), Black Spot of Grapes (*Elsinoe ampelina*), Downy Mildew of Grapes (*Plasmopara viticola*), Powdery Mildew of Grapes (*Uncinular necator*), Bunchy Top of Bananas, Bullet of Passion Fruit.

Fruit Tree Physiology

The quantity and quality of fruit produced is strongly influenced, if not determined, by the nutritional and water status of the plant.

Current irrigation practice has been very largely evolved from the concept that soil moisture is equally available to the plant between field capacity and wilting range. However, it is now necessary to recognise that this involves suboptimal levels at which yield and quality of product may be adversely affected. The extent and nature of the effects of suboptimal water levels require urgent study if irrigation practice is to be placed on a rational basis. This applies particularly to supplementary irrigation and where decisions are required as to the best use of limited water resources.

Despite many years of work, the relationships between fertiliser practice, tree nutrition and yield remain obscure and commercial fertiliser practices are determined, very largely, on empirical bases (Baxter 1958). The problem is complicated by the perennial nature of the plant in that the yield obtained is a function of the nutritional status, not only in the crop year, but also in the preceding year or two years. The processes involved relate to bud initiation, the differentiation of fruit buds and the storage of nutrients. In a similar way, environmental influences affect yield over a number of years.

The practice of pruning alters the balance between leaves, fruit and growing points and in this way, greatly affects nutritional levels. However, despite much study, pruning methods are still largely empirical (Whittaker 1958).

The Problem of Costs

The problem of costs may be approached by increasing yields or by reducing the costs of particular operations. Mechanisation is frequently a useful means of achieving the latter. Considerable advances have been made during recent years in pest and disease control by concentrate sprayers and misting machines, in fruit thinning by hormone sprays, and in marketing by bulk handling and automatic packing. Further exploration of these fields as well as those of pruning and harvesting would appear worthwhile. In seeking further mechanisation, it may be necessary to break with conventional orchard practice in other directions.

The Problem of Markets

Australia's expanding population will undoubtedly provide an expanding market. However, there is room for considerable increase in consumption levels. Thus the per capita consumption of fruit and fruit products during recent years have averaged about 160 lbs per annum which may be compared with 200 lbs per annum for the United States of America. The high figure for the U.S.A. is no doubt a reflection of attitude to fruit, and fruit products, such as canned and frozen juice. The development of a similar outlook in Australia could result in a considerable increase in fruit consumption. The wide range of climate of the Australian continent makes possible the production of a very wide range of fruit kinds and yet the avocado, the Macadamia nut, the custard apple and many other tropical and sub-tropical fruits are rarities in Australian homes.

Because of their perishable nature, most fruits must be consumed soon after maturity. This fact limits the quantities of individual fruit kinds which can be marketed from a particular producing area. With present knowledge, except for apples and pears, most fruits have a very short storage life and further research is needed to extend this and increase opportunities in both Australian and overseas markets.

For those industries with a high dependence on export markets such as fresh apples, can-

ning fruits, and dried vine fruits, further expansion of export markets, if not the maintenance of their existing share, will undoubtedly depend upon their ability to continue to meet price and quality competition.

The problem of costs, yields and quality represents a challenge to the fruit industry and to all those who work with it, including those engaged in research and extension services.

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Errata

Volume 26. No. 4. Page 363.

The title of the Technical Note should read:—

Variation in Disease Reaction within Bean (*Phaseolus vulgaris* L.) Varieties.

Volume 26. No. 4. Page 369.

The title of the Technical Note should read:—

The Effect of Stem Infection of Tobacco with *Peronospora tabacina* Adam on Foliage Reaction to Blue Mould.

INSECT PROBLEMS OF LUCERNE SEED PRODUCTION IN SOUTH AUSTRALIA

K. M. DOULL

A survey of the insects associated with lucerne in South Australia was undertaken over the period 1956-1959, emphasis being placed on those insects directly affecting seed yields. The results and conclusions of this survey are presented below.

Lucerne seed production has become an important enterprise for South Australian

farmers, who produce over half the total Australian seed. The crop is an uncertain one, however, and yields generally are low.

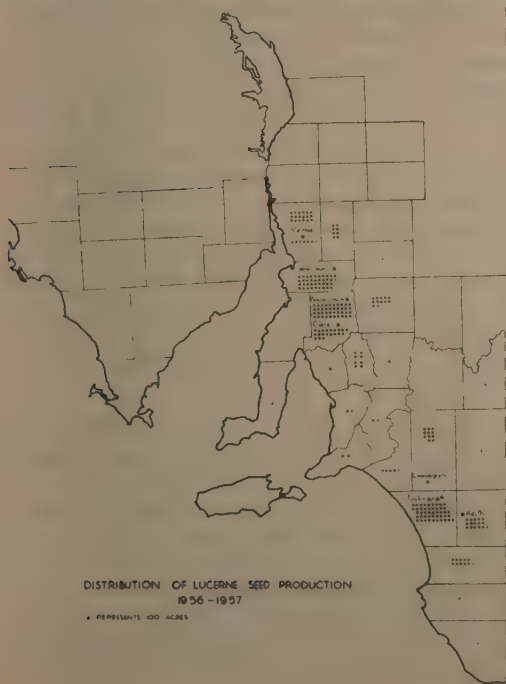
Most lucerne in the state is grown under dryland conditions, where soil moisture is a limiting factor. The area of lucerne seed grown under irrigation is small but is likely to increase and some high yields have been obtained from irrigated crops.

The distribution of lucerne seed production in the state is shown in Figure 1. The northern areas, on red-brown earths, have developed round the original seed fields of Booboowowie. The southern area embraces the recently developed sands of the Coonalpyn Downs — formerly known as the Ninety-Mile Desert. Rainfall ranges from 18-25 inches per year and in both areas rainfall in January and February is critical.

The statistics of lucerne seed production in South Australia for the period 1947-1957 are given in Table 1.

The average yield over this ten-year period was 66 lb per acre. The highest average yield recorded was 7.8 cwt per acre from 1400 acres in 1934.

Substantial increases in yield have been obtained in America, following research into the various aspects of lucerne seed production. In California the average yield per acre rose



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TABLE 1
Lucerne seed production in South Australia, 1947-57.

Year	Area (Acres)	Yield (cwt)		Gross Return	
		Total	Per Acre	Per Cwt	Per Acre
1947-48	10,254	5,085	0.50	£15 17 4	£ 7 18 8
1948-49	10,765	5,632	0.52	£13 6 0	£ 6 18 2
1949-50	14,030	9,008	0.64	£11 11 0	£ 7 7 6
1950-51	5,086	3,490	0.69	£23 9 10	£16 1 10
1951-52	7,956	4,767	0.60	£27 14 10	£16 6 8
1952-53	20,924	11,860	0.57	£13 17 5	£ 7 18 8
1953-54	15,079	9,976	0.66	£21 16 4	£14 7 7
1954-55	25,328	14,693	0.58	£29 15 0	£17 5 0
1955-56	26,357	13,445	0.51	£33 2 8	£16 18 10
1956-57	24,688	15,520	0.63	£21 10 3	£13 10 0

from 190 lb in 1946, to 460 lb in 1954 (Stanford *et al.* 1954), and in Utah, an increase from 30 lb in 1945 to 200 lb in 1955 was recorded (Bohart *et al.* 1955). These figures suggest that, provided modern methods of management replace those hitherto used in South Australia, increases in seed yields comparable with those obtained in the U.S.A. might be expected.

Throughout the state, despite the dominant part played by climatic conditions, insect activity is a major factor affecting seed yields. Insect pests cause some loss each year, and variations in the numbers and effectiveness of insect pollinators are responsible for much of the year to year variation.

Insect Pests

In South Australia, lucerne seed growers have to contend with relatively few serious insect pests. Only four species were found to be of economic importance during the period of this survey.

The pink cutworm, *Agrotis munda* Walk., has an indirect effect on seed yields by feeding on the plants in their early stages of growth. In the Coonalpyn Downs, attacks by this insect have been one of the major causes of poor lucerne establishment. Fields sown in the autumn are particularly susceptible to attack in their first spring, and most plants attacked are completely destroyed. In the north, damage occurs mainly in older stands. Larvae develop in the hay crop in October-

November and cause little harm. But when the hay is cut, the larvae eat the new shoots of lucerne so that there is little regrowth until the caterpillars cease feeding in December. This delays the seed crop, and weakens the plants so that seed yields are reduced.

The climbing cutworm *Heliothis punctigera* Wall., is the major pest of seed crops throughout the state. Where no lucerne is grown, *Heliothis* exists throughout the summer as small dispersed populations on weeds and garden plants; but in the lucerne-growing areas, where ample food is available for the larvae, populations may remain high throughout the summer with a new generation of moths emerging each month. The larvae feed on buds and flowers, and to a lesser extent on seed pods. In virtually all cases, buds and flowers attacked by *Heliothis* do not set seed. At times, a crop may have nearly all flowers damaged or destroyed. New flowers soon appear but the seed crop is delayed and the yield reduced.

The lucerne pod-borer *Etiella behrii* Zell., is a native moth which now permanently inhabits the lucerne fields of the state but appears to be most important in the Coonalpyn Downs area. Young larvae feed within the pods, destroying the seeds. At a late stage the caterpillars web a number of pods together and feed within the web. There are at least two generations in the summer, but the biology of this species is not yet clearly defined.

The lucerne seed chalcid *Bruchophagus gibbus* Boh. is a cosmopolitan insect. In South Australia it is of little significance in the south but may cause severe loss in the mid- and lower-north. Seed set in late February is most heavily attacked, and as much as 75 per cent. of this may be destroyed.

Other potential insect pests have been observed during this survey, but none have been found to cause much damage. They are probably controlled to some degree by sprays applied against *H. punctigera* and *E. behrii*.

The Activity of Pollinating Insects

Bohart (1957) in a review of the literature on lucerne pollination concludes that:—

A. Lucerne must be cross-pollinated by bees to produce a commercial seed crop.

B. Most species of native bees are very efficient pollinators but their numbers are rarely sufficient for commercial seed production.

C. Honeybees, when collecting nectar, are poor pollinators (except for a brief "learning" period) but when collecting pollen are reasonably efficient.

D. Despite their inefficiency, honeybees can set good crops of seed provided they are sufficiently abundant in the crop.

These conclusions also apply in South Australia and, within the limits imposed by climate and insect pests, poor pollination is the main reason for low seed yields.

Pollination efficiency can be determined by counts of flowers produced and seed pods formed. Lucerne flowers are produced on racemes bearing up to 30 flowers. When not pollinated all flowers fall without setting seed. When self-pollinated, only one or two pods are produced per raceme. But with cross-pollination, many racemes produce pods from all flowers. Self-pollinated pods are small and contain only one or two small seeds, while cross-pollinated pods may contain up to 12 seeds. Self-pollinated flowers, therefore, contribute very little to the final seed yield.

In 1959 a number of crops were examined in order to gain a preliminary assessment of the importance of pollinating insects. Over all the crops examined, 41 per cent. of racemes shed all their flowers and consequently produced no seed. When the racemes which did

produce pods were examined, it was found that only 21 per cent. of them were cross-pollinated. The final analysis of pollination efficiency was:

	per cent.
Racemes which set no seed	41
Racemes which were self-pollinated	47
Racemes which were cross-pollinated	12

Thus only 12 per cent. of the racemes produced contributed to the final seed yield. The failure of some racemes to set any seed was undoubtedly due to damage by *Heliothis* caterpillars. But even so, the low proportion of cross-pollinated flowers indicates that lack of pollination is one of the major causes of low yields of lucerne seed in South Australia.

Native solitary bees were not common nor did they, in general, appear to play a significant part in seed production. Two species of potential importance were found to be working lucerne in the southern seed-producing area, but none have so far been found in the north. Both are efficient pollinators.

A leaf-cutter bee *Megachile quinque-lineata* (Cockerell) is widely distributed in the Coonalpyn Downs although present in only small numbers. It is a ground-nesting species, preferring to use for its nests, burrows originally formed by spiders. When scrub is cleared and the country sown to pasture, *M. quinque-lineata* is deprived of suitable nesting sites and is then found only in scrub land. That it will nest in lucerne fields if suitable sites are available, was shown in one small lucerne field which had never been grazed. However its apparent preference for the burrows formed by one particular type of spider places a further restriction on the number of available nesting sites and hence upon the populations of this insect.

A species of Alkali bee, (*Nomia australica* Smith), was found to be colonizing suitable nesting areas in two irrigated crops at Bordertown on the southern fringe of the Coonalpyn Downs. Alkali bees are gregarious and nest together in fine textured soils, of a sandy nature. The most suitable soil seems to be one having a constant high moisture content and which is not flooded in summer or waterlogged in winter. Such favourable conditions occur in soils where there is seepage from

irrigation channels. Alkali bees are the most important of the wild pollinators of lucerne (Bohart 1955) and their appearance in some South Australian lucerne fields is encouraging.

Honeybees and Lucerne Pollination

The small numbers of wild insect pollinators means that South Australian lucerne growers are almost completely dependent upon honeybees for the production of seed crops; but the beekeeping industry in the state is not strong enough to provide sufficient hives to pollinate the large area of lucerne harvested for seed each year.

Bohart (1955) estimated that three to six hives per acre were necessary for best results, the actual number depending, among other things, on crop density, competing sources of nectar, and hive strength. In South Australia, 26,357 acres of lucerne seed were harvested in 1955-56. This, on American standards, would have required a minimum of 79,000 hives. There were 76,918 registered beehives in the state that year. Of these 42,000 were owned by amateur or part-time beekeepers, having less than 200 hives each. Few of these would be in the lucerne seed areas. Many of the remaining 34,000 hives were not available to lucerne growers for various reasons, so that at most, not more than 25,000 hives could have played any part in lucerne seed production.

The presence of quite large numbers of wild swarms of honeybees is an important factor, particularly in the north of the state. It is likely that these wild swarms, together with a possible small population of native pollinators, were responsible for most of the seed produced by some crops.

Because it produces little pollen or nectar and is also difficult for bees to work, lucerne is not a favoured bee-forage crop. As a result it competes poorly with many other nectar and pollen-producing plants. In South Australia eucalypts in particular are strong competitors. Red gum (*Eucalyptus camaldulensis*) is an important competing plant for its flowering in December and January coincides with the flowering of early lucerne crops. Bees rarely visit lucerne while red gum is flowering. On the other hand, blue gum (*Eucalyptus*

leucoxylon) is complementary. It produces little pollen but a good nectar supply. This latter stimulates the bees to breed, with the result that the pollen demand of the hives is increased. The bees then become very active in lucerne. Good seed setting may occur in early December in blue gum areas. In general however, as a result of the arid summers of South Australia, there is little real competition during January and February when most lucerne crops are in flower and honeybees will work the crop quite readily.

The Potential Seed Yield of Lucerne in South Australia

The first commercial crops of lucerne seed in the state were harvested in 1926. The mean yield for the period 1926-36 was 190 lb per acre and yields of 400 lb per acre were not uncommon. But, over the past ten years seed yield of dryland lucerne has not often exceeded 200 lb per acre, and yields as low as 30 lb per acre are common. However, the higher yields obtained in the early years of seed production suggest that the seed potential of Hunter River lucerne is as high as that of the commercial strains grown overseas.

Irrigated lucerne in particular has a very high potential. The best yield so far obtained, was harvested at Bordertown in 1957. A field of four acres, with a previous best yield of 400 lb per acre, yielded 11 cwt of clean seed per acre after 26 hives of bees had been placed alongside it. In 1958-59 a fourteen acre crop in the same area, also with an adequate population of bees, produced 1000 pounds of clean seed per acre in its first year of harvesting and in 1960 a 20 acre field yielded 1000 lb per acre. Yields in excess of 600 lb per acre have been obtained from other crops in the Bordertown district, where beekeepers and growers are beginning to co-operate to their mutual benefit.

Increased yields of dryland lucerne have also been achieved when honeybees have been brought into the crop. However, the dominant part played by climate and the greater problems of insect damage in dryland crops make it difficult to determine how much of the increase was due to better pollination and how much to more efficient insect control and to climate.

Conclusions

The hot, dry, sunny weather of the South Australian summer is well suited to the production of high quality lucerne seed. Hunter River lucerne appears to have a potential for seed production much in excess of the present yields of either dryland or irrigated lucerne.

At present day prices, dryland seed production is a profitable enterprise; but if seed yields can be increased, prices may fall and lucerne seed will no longer be a profitable crop on what is virtually marginal land. The high yields that appear possible under irrigation suggest that lucerne seed production could become a major enterprise in irrigation areas throughout the state.

Increased yields, however, are dependent upon changes in management, upon better control of insect pests and upon more efficient pollination. Some increase is possible from any one of these factors but maximum increases can only be achieved when attention is given to all three factors.

There is little that can be done on the management side while the seed crop is secondary to grazing and hay. But when growers begin to specialise in seed production under irrigation, changes in management should lead to increased seed yields.

Improved control of insect pests is essential. *Heliothis* in particular can cause heavy loss in a short time and there is little hope of achieving high yields unless this insect is controlled. The control of *Etiella* too, is most inefficient and improved control could help to lift seed yields. Better methods of control of *Etiella* are dependent upon the results of current research into its biology.

In the northern areas there is an urgent need for a better knowledge of the biology of *B. gibbus*. No chemical control is possible at present and no other methods can be formulated until more is known of the biology of the insect.

Pollination problems are complex and are in many cases peculiar to Australia. While the introduction of a sufficient number of bees

to any crop should result in an increase in yield this is not automatic. Bees may refuse to work the flowers, or weather conditions may prevent flight; and *Heliothis* may destroy so many flowers that there are few left for the bees to work.

Many of the modern insecticides are highly toxic to bees and at times the insecticides that can be used do not always give the best control of insect pests. In South Australia the only insecticide in general use in lucerne crops is DDT. At the low rates recommended DDT has no detrimental effect on bees and yet gives adequate control of *Heliothis*. Parathion as used for the control of *Etiella* has not so far been troublesome to bees, although if spray rates were increased losses of bees could occur. The problem is one of which growers and beekeepers must be aware.

Quite apart from these problems, the shortage of bees is a major factor preventing a general increase in seed yields throughout the state. Until the beekeeping industry is expanded and beekeepers become experienced in the techniques of providing bees for pollination, low seed yields will continue to be the rule rather than the exception. Planned Pollination services are developing in the southern seed areas. Experience gained by growers and beekeepers in this area will provide a useful basis for the eventual development of better pollination.

It is, however, likely to be some years before Planned Pollination is fully developed in South Australia. In the meantime research into native pollinators could show how their numbers may be increased in the lucerne fields of the state.

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A SAMPLE CENSUS OF CATTLE IN THE EAST KIMBERLEY REGION

J. B. RITSON and
M. J. T. NORMAN

On a majority of the cattle stations in the East Kimberley region, there is little segregation of classes of stock other than the provision of a holding paddock for bullocks destined to be drafted off. As a consequence, there is little or no control over time of mating or age of heifers at first mating, and no assistance to newly-weaned calves in the form of a reserved paddock.

As an example of the effects of uncontrolled breeding, the Kimberley Research Station recently obtained a group of supposedly maiden heifers, averaging 6 months old, from a commercial property in the region, and out of a total of 32, 12 produced calves.

In order to provide background information for future experimental work at the Research Station on the effects of breeding control on the productivity of herds, a sample census was carried out in the 1959 dry season of cattle on a selected group of stations in the region.

Methods

Cattle were counted on seven stations, chosen as a cross-section of properties in the area with respect to size, degree of improvement, pasture type and topography. All the stations send their cattle to the Wyndham meatworks. Counts were made at several of the normal dry-season musters on the properties concerned by the senior author between April 20 and September 24. The cattle counted were classified into 16 groups.

Entire males	}	X	Under 1 year old
Castrated males			1 - 2 year old
Entire females			2 - 4 years old
Speyed females			Over 4 years old

Since in some instances counts had to be made from horseback of a mob being drafted in the open, a more detailed classification was not possible. Even with this broad grouping, there was probably an appreciable margin of error in the estimate of age. In addition, the cattle that escaped being mustered were likely to have included a higher proportion of old bulls than those that were rounded up and counted, and this class of cattle may have been underestimated.

Results

During the five month period 23 musters were attended and a total of 10,566 cattle counted. A full classification is given in Table 1.

In Table 2, the cattle have been grouped according to age and sex only. The table suggests that, over the past four years at least, the average annual calf drop has remained

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TABLE 1

Full classification of cattle by age, sex and property.

Sex Class	Age Group	Properties							Total
		A	B	C	D	E	F	G	
Entire males	1 year	160	34	140	118	61	175	156	844
	1-2 years	11	5	56	17	9	27	49	174
	2-4 "	23	5	36	35	20	34	57	210
	4 "	12	1	9	20	22	29	15	108
	Total	206	45	241	190	112	265	277	1336
Castrated males	1 year	67	23	55	148	48	18	27	386
	1-2 years	242	85	263	66	121	82	67	926
	2-4 "	194	127	545	277	178	127	84	1532
	4 "	18	4	28	36	26	44	30	186
	Total	521	239	891	527	373	271	208	3030
Entire females	1 year	226	37	135	266	103	195	192	1154
	1-2 years	225	76	220	119	138	129	216	1123
	2-4 "	448	100	389	409	170	328	312	2156
	4 "	243	55	212	295	110	237	270	1422
	Total	1142	268	956	1089	521	889	990	5855
Speyed females	1 year	—	—	—	—	—	—	—	—
	1-2 years	12	—	79	—	5	—	1	97
	2-4 "	26	2	111	4	55	—	2	200
	4 "	7	—	15	5	16	4	1	48
	Total	45	2	205	9	76	4	4	345
Total All classes and ages		1914	554	2293	1815	1082	1429	1479	10566

fairly constant, though Table 1 shows that there has been some variation within individual stations. The total number of cattle less than

one year old was approximately the same as that between one and two years, and for females the number in the double age-group two to four years was approximately twice that of the younger classes.

TABLE 2

Cattle generations.

Age group	All males	All females	All cattle
less than			
1 year	1230	1154	2384
1-2 years	1100	1220	2320
2-4 "	1742	2356	4098
more than			
4 years	294	1470	1764
Total	4366	6200	10566

The number of males over four years was small. In this region the majority of steers are turned off at three to four years. Moreover, Table 1 shows that more than one-third of the males remaining after four years were entire.

The number of females over four years was only a little more than that of a single year's drop of younger females. If the annual average calf drop had remained relatively constant over the past six to eight years, Table 2 would indicate that the average life of a

TABLE 3

*Bull/breeder ratio.**(Entire males over one year as percentage of entire females over one year.)*

Property	Ratio
A	5.0
B	4.8
C	12.3
D	8.7
E	12.2
F	13.0
G	15.2
Mean.	10.5

breeder in the region is only five to six years. However, records from the Research Station show that in 1952-53 and 1953-54 rainfall was only two-thirds of the average, and it is possible that this dry period influenced the numbers of six and seven year old breeders counted in 1959. On the other hand, even if the number of female calves in these two years was only half the normal drop, Table 2 would still suggest that the average life of a breeder is not more than six or seven years.

The ratio of bulls to breeders is given in Table 3, in terms of entire males more than one year old as a percentage of entire females more than one year old. The experience with the Research Station heifers suggests that, under East Kimberley conditions, "breeders" should be interpreted as females over three to six months old, but the broad classification adopted did not reveal this figure.

The ratio of bulls to breeders varied appreciably between properties. On properties A and B it was only 5 per cent., which, if the census did not grossly underestimate the number of bulls through inability to muster them, is satisfactory. On the other hand, on properties C, E, F, and G it was over 12 per cent., an unnecessarily high figure. Table 1 shows that properties F and G carried a much higher proportion of old bulls in relation to total population than other stations. It should

be pointed out that a low proportion of bulls is not wholly a reflection of efficient branding, since in this region their number is also kept down by the wasteful yet necessary process of shooting them out.

Table 4 gives the closest estimate possible from the census classification of weaning percentage—all cattle less than one year old as a percentage of the potential breeders, i.e. all entire females more than one year old. The average weaning percentage on this basis was only 51 per cent., without a great deal of variation between stations.

It is not known at what stage between conception and weaning these heavy losses occur. Failure to conceive annually through poor nutrition, missed service through isolation in rugged country, permanent infertility following mating at an excessively early age, abortion, losses at calving, losses during the suckling period in the calf's first dry season—all probably contribute to the low proportion of calves raised. However, the figures in Table 2 suggest that if a calf lives to one year old then, as a male, it has a good chance of survival until turn-off at three to four years, and as a female until it is five to seven years old.

Discussion

It thus appears that the weak links in the chain of productivity in the East Kimberley region

TABLE 4

*Weaning Percentage.**(All cattle under one year as percentage of entire females over one year.)*

Property	Ratio
A	49
B	41
C	40
D	65
E	51
F	56
G	47
Mean	51

are in the proportion of calves raised and in the life of the breeder rather than in losses between one and four years old.

Prolongation of the useful life of the breeder should be an important aim in improving turn-off of northern stations. However, it would seem far more important to concentrate on raising the weaning percentage, which would not only increase the turn-off of steers but also allow a more vigorous programme of speying and breeder replacement.

The most effective methods of raising the weaning percentage would be through the control of breeding and the improvement of dry season nutritive levels for breeders and young stock. The objectives of breeding control, through proper subdivision, would be:

A. To control the age of heifers at first mating, thereby avoiding excessively early calving, of which the Research Station cattle were an example.

B. To control the time of mating. Without control, this is governed by the activity of bulls and receptivity of cows in response to seasonal changes in pasture quality, with the result that calves are dropped in late dry-season, the worst period of the year. By delaying mating until late wet-season, calves would be dropped at the beginning of the next wet season with good quality pasture available during early lactation.

C. To control weaning. At present, it is not unusual for calves to remain on their dams

until the following calf. The aim, once time of mating was fixed, would be to wean in early dry season into a reserved paddock, giving the dam an adequate recovery period and relieving the weaner from the necessity of competing with older cattle for good quality pasture.

The most hopeful avenue for the future in raising the dry season nutritive standards of breeders and young stock appears to be through the provision of protein supplements. Protein-rich meal could become available from the future Ord River irrigation area as a by-product of oil-seed crops — safflower, linseed, probably cotton and possibly soya bean.

At this point it is not possible to predict the result of applying these methods. The data in Table 2 suggest that the present annual turn-off is of the order of 10 per cent. (1100 males, less a proportion of bulls remaining, plus a proportion of speyed cows marketed, out of a total of 10,500). If the weaning percentage could be raised to 80 or above through breeding control and winter supplementation, and steers marketed at two to three years rather than three to four years, a tripling of beef output from East Kimberley region without any increase in stocking rate would be within the bounds of possibility.

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FARM ACCIDENTS AND SAFETY

G. H. VASEY

In recent years several Industrial Safety Conventions have been held, state-wide and Commonwealth-wide. Until now none of these occasions has found room for a session or discussion on accidents or safety in the farming and grazing pursuits.

These omissions represent yet again the theme that if a visitor were to judge Australian agriculture on the basis of the official activities and publications, he would come to the conclusion that our agricultural produce was raised largely without the aid of power and machinery.

This obviously is not so; the inclusion of this session in the Convention's activities is a welcome recognition of it, even though the theme is necessarily the negative one, in effect, of how to prevent losses, rather than how to promote gains.

Farm accidents cover the whole range of industrial accidents, as well as typical domestic accidents, and besides these, some that are peculiar to working in the countryside (as distinct from inside factories) and still others that are specific to the occupations of farming, grazing, dairying.

A farmer is not likely to fall from a dog-man's hook, but he could fall from the loading platform of his barn or from a haystack. A farmer is not likely to be caught in a hundred ton press, or a plate-cutting shears, but he could suffer damage in a hay baler or post-hole digger. A farmer is not likely to be splashed with molten steel from a crucible, but he could suffer skin and other damage from parathion and other toxic substances.

Farming and Factory Risks

In a comparison between factory and farm accidents, there are several points of distinction to remember:

1. Per worker, the farmer might have more machines, though only one at a time, and each

for only a few days or weeks a year. Even the average use of the tractor is only about 1000 hours a year. So that, by and large, the farmer's routines are more varied, or in effect less routine, and so less likely to have safety measures built into them.

2. The farmer's machines (at any rate the field machines) differ by being fed into the work, not the work into the machines; i.e., the machines, besides being functional, are also mobile or self propelled; and by the fact that the work or 'raw stock' input, in the form of biological materials and soils, is highly variable. For these reasons the machines require frequent adjustment to the variable circumstances of work and terrain.

3. Apart from inherent variations in the raw stock, the field machines work in a bad environment for mechanisms and machines, unless or even if they are totally enclosed or sealed. Though sealed bearings are now accepted as possible, if not yet conventional, the machines are nowhere near being designed to be totally enclosed. The fact is that most field machines are relatively open, and require frequent maintenance, not always at convenient places. These features mean that these machines are inherently dangerous, and therefore require special measures for their safe working and maintenance.

4. Tillage equipments, though they may have no moving mechanisms, have one or more — usually a gang or assembly — of cutting tools, all exposed in their supporting frame, against which there is no protection, if by some accident one falls on to them or in front of them.

5. Most of this equipment is towed by a tractor, though some is self propelled. The automotive unit has its own dangers arising

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from its motion, often on uneven ground, with variable traction, and sometimes steep slopes.

The motion of such vehicles is complicated either by the tow, as in jack-knifing accidents, or by attachments, especially front and back end loaders that may raise the centre of gravity, or bring it closer to the back axle. These situations raise problems of stability not usually encountered in road vehicles, though earth-moving plant runs similar risks.

6. Apart from this question of stability, the automotive unit has further risks of collision either with fixed or moving objects, or with pedestrians, as with any free moving vehicle. And this raises further risks to passengers for which there is no proper accommodation.

7. Given all these risks with awkward machinery in awkward work in awkward conditions, the farmer, be he ever so conscious of the need for safe working, suffers a double disadvantage through working in isolation, virtually single-handed as well as remote. He has neither supervision, nor as a rule special training, nor safety officers; his plight in difficulties is likely to pass unnoticed for some hours, and, when found, a recovery team must still be sent for; even then he may be a long way from medical aid.

8. Two other features of the farmer's work that distinguish his risks from those of the factory worker are the 24-hours-a-day job, and the all-weathers job. In these ways, the farmer's job is something like the mariner's on a small ship: the work must go on, especially with animals, fair weather or foul, and there is no one else to do it, no question of watches or shifts.

Apart from the question of fatigue through keeping long hours, the wet weather work, especially in emergency, multiplies the risks: the simplest job becomes dangerous because of wet and cold hands, heavy clothing, slippery footings, unmanageable vehicles and frantic animals. Even hand tools, like picks, shovels and axes, need new techniques under those conditions.

Even if we do not list all the accidents or classes of accident that might befall in using field machinery and tractors, it is clear enough that the farmer is much worse off than the

factory worker both in the class of machines he works with, and the circumstances in which he works them.

Other Rural Workers

It is perhaps worth noting that, in the kinds of machines he uses and in the rural environment, the farm worker is in much the same situation as other rural workers, e.g. in forestry, earthmoving and construction jobs. Though each of these has its own further special risks (e.g., falling and rolling timber, saws, hauling cables), the individual worker has the advantage of working in a group, probably in sight of his co-workers, who could quickly come to his aid; and of working under supervision, and under the influence of safety propaganda and instructions.

Occupational Damage

These groups also suffer the other risks of the rural life, such as insects and snakes (a risk that is small though not zero), and fire. They and the farm workers also suffer a special occupational hazard associated with tractors, namely damage from vibration and noise. Research workers and medicos are coming to the conclusion that tractor drivers suffer damaging vibrations in the low frequency range of 1 to 10 cycles/second; tests at the tractor station at Werribee suggest that the noise level around tractors (at 100 to 110 decibels re 0.0002 dyne/sq cm) is much above the 85 decibel level considered acceptable in industry.

Other Mechanical Accidents

Both in industry and in farming, by no means all the 'mechanical' types of accident involve either the running or even the presence of machines. Many accidents arise from trips, traps, falls, slips, ladders and scaffolding, lifting and moving, steps and stairs.

In factories, step-changes in floor level are avoided, decks are kept clear, ladders and scaffolding are checked, lifting will be done by cranes and hoists and power lifts, running may even be prohibited. But farmers as a class are not so careful on these matters; the working space is usually fully cluttered up with impediments through which one cannot rush, but must pick one's way. Nor is a farmer

particularly trained at ropes and lashings, joints and fastenings, footings and supports, though he may manage on most occasions to load his animals into a truck, and lift his superphosphate six bags high.

Non-Mechanical Accidents

Nor are all industrial accidents to do with falls and collisions, or with machinery and foreign (solid) bodies. Listing all accidents shows a wide range of other industrial risks, that the farmer also suffers—for example burns by contact with hot objects, damage to skin (and clothing) and to the eye and respiratory organs from chemicals in the form of liquids and dusts.

One can imagine that in the manufacture of toxic substances the risk must be high; but one can also suppose that these plants are fully enclosed and protected, and the procedures very carefully controlled. It is likely that the user, at the point of use—in opening cans and pouring from one vessel to another—is exposed to greater risks through lack of control or skill in techniques, and perhaps through lack of understanding the dangers.

On the other hand some spray materials and powders are so dangerous that protective clothing is essential. Though the factory worker is compelled to adopt such practices, they tend to be irksome and so avoided by the unsupervised rural worker.

Accidents with Animals

This type of accident is specific to workers with stock, in stock yards and abattoirs, as well as in the farm yards and pens, or even in the show ring. It may be supposed that the proper handling of animals—for the sake of the animals too—is an inbred tradition, strictly observed by stockmen, who may never have heard of safety rules as such, and would hardly welcome the ministrations of the National Safety Council on their behalf.

Even so, accidents do happen, though perhaps most on the less regulated properties. Not uncommonly accidents with bulls occur to those in whom familiarity has bred something close to contempt.

Spectacular Problems, Specific Remedies

Notwithstanding the almost infinite scope for accidents, some likely to be common, some rare, the majority go unrecorded and unreported; we become aware only by the down column headline in the paper 'Tractor overturns: man killed' or suitable variants on this theme.

Some guess that in Australia perhaps 50 people are killed by tractors each year, in New Zealand they say it is 15, in Great Britain 40. It is these fatalities, rather than the sum total loss of time and material in the minor and less than fatal accidents, that prompt action.

Promptings have come from

1. The Tractor Trade Association, who urged that the N.S.C. appoint a sub-committee to do something about tractor safety.
2. The N.S.C. committee drew up a complete set of safety rules, and a condensed set on a transfer for fixing on tractors and like equipment, but has failed to prompt anyone into paying the cost of printing and publishing these rules.
3. Inventors have come up with designs and gadgets for the purpose of rendering the tractor safe at the penultimate moment of a roll or tip-up; some of these inventors have sought 'approving' tests from the Tractor Testing Committee. (This committee will not consider gadgets that rely on limit-setting devices to issue warnings or turn off the power in mid-flight; it is willing to consider structural attachments aimed at physically stopping a tip-up or roll, or possibly at providing structural protection to the driver).
4. The Commonwealth Government, through the Agricultural Council, has suggested that the Tractor Testing Committee take up a 'watching brief' on tractor stability, as being a problem within the scope of the committee. The Testing Officers are currently working on the mechanics of tractor stability, and are setting up a radio-controlled tractor to aid in the testing of structural 'safety' devices, and to conduct some research.
5. The N.S.C. has now widened the scope of its sub-committee to go beyond tractors, and into farm safety in general. This is a much

wider topic, as this paper suggests, with a great quantity of unknown data, in an industry composed of 250 thousand individual units over all Australia.

Whatever may come of this and all the other studies, if unsafe practices (or some of them) can be proscribed by legislation, there is a precedent in the (UK) Safety Health and Welfare in Agriculture Act (1956) and the regulations under it. (For example, under this Act, it is an offence to allow children (under 16) to ride on tractors; the heaviest weight that may be carried (by children or young persons) is prescribed).

For an example in the co-operative study of fatal tractor accidents (or perhaps all farm accidents), we can go to New Zealand, where the police and the Department of Agriculture jointly inspect the event and report on it.

The Problem of Statistics and Propaganda

The recurring theme in this summary has been the isolation of the farm and the farm worker. That means that the farmer is relatively, even

largely, inaccessible both as a source of facts about farm accidents, and as the receiving point for propaganda and advice.

The farmer and his business are essentially a discrete individual, not a group in a factory or works, nor accessible through the management, nor traceable (as to accidents) through management's records. There are far more individual farms and farm workers than there are registered businesses and factories.

This diversity of risk, the individuality of the enterprises, and the widespread and thin dispersion of the enterprises over the countryside, raise difficult problems of approach to safety.

Meanwhile, relative to the number of people employed, and to the value of the national product, the primary industries deserve as much attention as the secondary industries do in the matter of safe design of equipment, the safe working of equipment, and safety procedures generally.

Predicting Beef Cattle Gains on Native Pasture at Katherine, N.T.

Most of the cattle fattening systems envisaged in any future development of the Katherine region for intensive animal husbandry, though based on sown pastures and fodder crops, would involve the use of native pasture either for the whole of the wet season or for the first part of it.

Cattle on native pasture gain 100 to 300 lb per head from the beginning of the wet season until one or two months after the rains end, a period of approximately 6 months (Norman and Arndt 1959). After this they lose weight until the start of the next wet season. Since the amount of weight put on appeared to be

dependent upon size of frame, as influenced by age, and condition at the beginning of the gain period, influenced by previous feeding level, quantitative relationships between these variables were examined for groups of experimental cattle at the Katherine Research Station.

Data were available for 10 group-year combinations between 1956 and 1960. In some instances these were the same group of cattle in successive years, in others they were matched groups of the same age but in different condition. The numbers in each group varied from 6 to 12, with an average of 8. Ages were known to within 3 months. All the cattle were locally-bred Shorthorn steers. The groups varied from 15-month animals in excellent condition weighing over 500 lb per head, to 8-year-olds that had spent the previous dry season on native pasture alone and had fallen to 750 lb per head — as wide a range as would be encountered in practice.

A good linear relationship was established between age divided by starting weight and the rate of gain, both for the full wet-season gain period of 24 weeks and for the first 12 weeks only (Figs. 1 and 2 respectively).

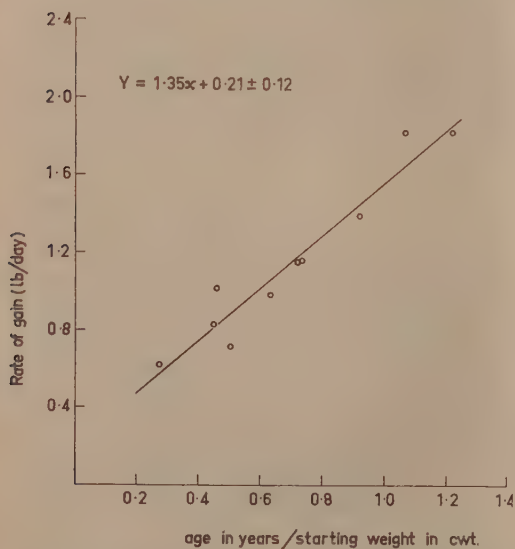


Figure 1. Relation between age/weight ratio and rate of gain for 24 weeks of wet-season gain period.

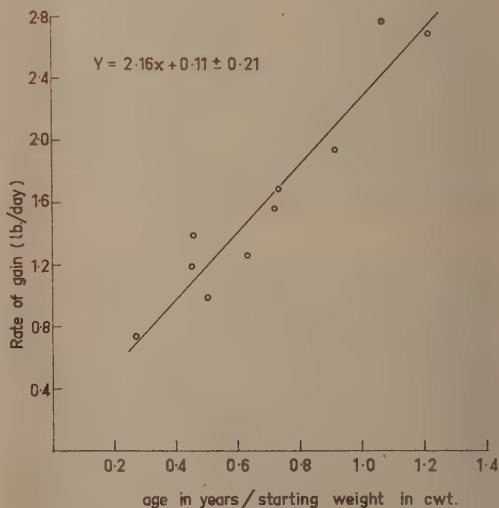


Figure 2.—Relation between age/weight ratio and rate of gain for first 12 weeks of wet season.

Applying the equations, a 3-year-old store weighting 5 cwt at the start of the wet season would be expected to gain at a rate of 1.02 lb per day for the full 24 weeks and at 1.41 lb per day for the first 12 weeks. On the other hand, a 2-year-old store in better condition and of the same starting weight would be expected to gain at only 0.75 and 0.97 lb per day respectively. The standard errors of these estimates are 0.12 and 0.21 lb per day, or 18-20 lb of the total gain in both instances.

With respect to the rate of loss on native pasture in the dry season, it would be expected that the effects of age and condition would in this instance tend to augment rather than to cancel each other. The greatest losses would be sustained by large-framed cattle in good condition, i.e., those with the highest maintenance requirement, and the least by young

cattle in poor condition. However, although this is true in general terms at Katherine, no clear relationship between rate of dry season loss and age and weight combined in expressions representative of augmenting effects could be established from the data available.

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Australian Sheep Blowfly Infesting a Bullock

*A record is presented of the first known case of *Lucilia cuprina* causing true cutaneous myiasis of a bovine.*

In September 1959 a five-year old bullock at Yeerongpilly was found to be infested with blowfly larvae feeding in a compact mass 3-4 inches in diameter, centred about 6 inches in front of the butt of the tail. Larvae were collected after falling fully-fed from the bullock, and the 20 flies which emerged were all *Lucilia cuprina* (Wied.) (Diptera: Calliphoridae). Before becoming fly-blown the bullock had been kept in a well-ventilated, rain-proof stall for 15 months while successive cultures of cattle ticks, *Boophilus microplus* (Can.), were raised upon it. There was no evidence of a lesion preceding the myiasis, other than possible tick bites, nor of an extraneous attractant in the hair other than tick excreta.

Previous records of *L. cuprina* infesting cattle have related only to traumatic myiasis (Veneroni 1926, Rao and Pillay 1936). Other species of *Lucilia* (*Phaenicia*) have also been recorded from wounds on cattle, and *L. sericata* was involved in cutaneous myiasis incurred by calves in the Hawaiian Islands under the abnormal circumstances that wet weather prevented their coats from drying out after birth (Holdaway 1943, and in Rogoff and Barton Browne 1958). Although *Lucilia cuprina* is a formidable agent of cutaneous myiasis of sheep, the infestation of the bullock at Yeerongpilly appears to be the first record of the species causing cutaneous myiasis of a bovine. The lack of published records confirms the experience of the present authors and their colleagues: blowfly eggs or larvae have never been encountered in the coats of the many hundreds of bovines they have examined in the course of cattle tick and buffalo fly investigations. This is of particular interest in view of the fact that Rogoff and Barton Browne (1958) found that cattle hair arranged

in bundles around cotton-wool plugs soaked in indole-ammonium carbonate solution was as attractive as an oviposition site for *L. cuprina* as was sheep fleece similarly arranged.

Presumably under paddock conditions some factors operate against the accumulation on cattle of substances which attract gravid blowflies, and stimulate them to lay. Cattle are prone to lick their bodies, and this would normally reduce the accumulation of tick faeces (guanine and partly digested blood — Enigk and Grittner 1952) or other attractive material in the hair. By contrast the Yeerongpilly bullock had been tethered to restrain licking — in the interests of increasing tick yield (Snowball 1957) — for about two weeks preceding the probable time of initiation of the strike, and there was a noticeable accumulation of tick faeces in the hair when the maggots were collected. The complete protection of the bullock from rain may also have minimised loss of tick faeces from the coat. The repeated tick bites which the bullock experienced perhaps enhanced the risk of myiasis, under the conditions of stalling, though many Queensland cattle, at pasture, frequently carry heavy tick infestations without incurring fly strike.

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Establishment of a Senior Lectureship in Extension Methods in the University of Queensland

For the last 50 years, there has been a glamour about research, and the attraction to the research field does not wane — may it never do so.

On the other hand, there has been little call for University graduates to enter the agricultural extension services in Australia. Only in the Department of Agriculture in Western Australia has it been the settled policy to use University graduates for extension work; in

other States this field has been generally considered more suitable for the College diplomate. While College diplomates have given splendid service in the past, the future seems certain to bring increasing demand for University graduates in the extension services and it is time Universities prepared their students for this work.

There is no doubt that preparation for the extension services should be taken seriously — just as seriously as for a research career. Federal and State agricultural authorities have given a lead in this direction through the convening of conferences and the conduct of short-term training schools for staff.

The approach to extension work has changed radically in recent years. No longer can it be limited to advice on the treatment of

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a sick cow, the best variety of oats for a paddock, or a suitable fertiliser mixture. Extension work involves assistance to the farming community in the best use of resources, and the improvement of living standards and cultural conditions. In view of this, mere technical competence is inadequate for the extension worker; he must know something of rural sociology and psychology and understand the economic and social implications of any recommendations.

The Federal President of the Australian Institute of Agricultural Science, Mr. R. M. Moore, stated in his Presidential Address in 1959 "that the Institute should endeavour to persuade an Australian University to establish a postgraduate course in Sociology and Extension Methods for agriculturalists" (*J. Aust. Inst. Agric. Sci.* 25 No. 3, pp. 171-174). The University of Melbourne already has a Senior Lectureship in Rural Sociology and other Agricultural Faculties in Australia give some attention to the principles of extension in undergraduate courses. This is a start, but far from an adequate approach to a training for extension work.

The University of Queensland has been considering this question for some years and has decided on the establishment of a Senior Lectureship in Extension Methods as soon as funds could be made available. The use of the term "Extension Methods" does not imply a superficial approach. It is envisaged that the training will involve the basic principles as a foundation for practical applications in the rural field and will be associated with a research programme. It was also recognised that a little more information crowded into the undergraduate course, or even replacing some of the established course work, would be inadequate. A postgraduate course would be necessary, similar in principle to that leading to the Diploma of Education in the Faculties of Education.

There can be no question that an agricultural extension officer needs sound training in Agricultural Science, and the minimum basis would be the Bachelor's degree. Following this, training would be required in Rural Sociology, Psychology, further Agricultural Economics,

and the techniques of Extension Methods and their application in the farming community. Such a course over an academic year could lead to a graduate Diploma in Agricultural Extension. Associated with the course would be an active research programme in the farming community to determine the needs of the farmers for, and their reactions to, various types of Extension Methods. Research should lead to improved methods.

To organise and lead this course and the associated research programme, a Senior Lecturer is to be appointed. It is envisaged that the appointee will be a specialist in Extension, covering both the basic discipline of Rural Sociology and its application in Extension Methods calculated to attract farmers and to encourage them to take early advantage of proven research findings. He will be accommodated in the University Department of Agriculture associated with specialists in various fields of Agricultural Science and will have access to other fields of learning. He will make use of courses which could be provided in the Faculties of Arts and Education. Furthermore, he will be in close contact with the C.S.I.R.O. laboratories and State Department of Agriculture and Stock.

Through the generosity of the Reserve Bank of Australia, a grant-in-aid of £2,000 per year for 6 years from the Rural Credits Development Fund has been made available to the University of Queensland for the establishment of this Senior Lectureship. It is hoped to make an appointment and commence the course in 1962.

From the reactions of students of agricultural science in the University of Queensland, it is expected that this course will be popular. It is expected that students from other disciplines with an application to agriculture will be attracted. The University of Queensland offers the course to graduates of other Australian Universities and to qualified overseas students, and hopes that many will take advantage of the training provided.

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An Important Future Task for the Institute

Perhaps the most important future task of the Institute should be to co-operate with other bodies in developing a new approach to the administration of research funds. The last five years have been characterised by increasing grants from the governmental sources and also by the fact that the various branches of the agricultural industry, being aware of the necessity of the services of agricultural science, have levied themselves in order to support research.

This development brings with it a responsibility to ensure that the best advantage is taken of the funds available. I would suggest that the time is ripe for the establishment of an Australian equivalent of the British Agricultural Research Council to assist in the administration of the funds.

The British Agricultural Research Council recognises the importance of fundamental research to maintain a constant supply of new knowledge without which applied research would soon come to a standstill. In Australia the amount of funds available for research in this category is dangerously small. Agricultural research is probably the most complicated undertaken anywhere in the field of science as the growth of plant and animals is the consequence of so many factors. Far too often agricultural scientists are called upon to solve apparently simple problems, which on investigation prove insoluble, because existing knowledge is fragmentary. Unfortunately it is often very difficult, and in some cases impossible to obtain funds to investigate these problems because no immediate practical solution or application is in sight. This situation if it persists will ultimately mean that our archives will be filled with partly explained experimental results, and more seriously that the development of our knowledge of the fundamental principles governing the field behaviour of our plants and animals will be seriously retarded.

The British Agricultural Research Council arose out of the provisions of the Development and Road Improvement Act of 1909. It was not until 1931 following the temporary check caused by the First World War that the Agricultural Research Council was set up to advise on the running of the Research Institutes, to act as scientific adviser to the Development Commission, and to expend additional monies at its own discretion. Today, the Agricultural Research Council completely administers the agricultural research responsibilities formerly carried out by the Development Commission.

The Council, which consists principally of eminent scientists together with government and industry representatives, also has the power to initiate research when and where necessary, and is thus largely responsible for agricultural research throughout England, Scotland and Wales. Several of the special research units are in fact located within Universities.

It is interesting to note that the Council does not have precisely defined terms of reference, but is free to encourage research in fields where it is most needed. It is also significant that it does not attempt central direction of research but works on the principle that able research workers will make the greatest contribution if allowed to develop their interests within the general requirement of the agricultural services.

It is highly significant that the Council encourages the formation of State aided Research Institutes which are jointly administered by scientists, farmers and Departments of Agriculture.

This and other tasks of similar nature should form the most important part of the future work of the Institute.

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Farm Policy

An occasional bulletin on economic policies

For information on price and availability write to Dr. H. Schapper, University of Western Australia, Nedlands.

This is the first edition of a new bulletin edited by Dr. Henry P. Schapper, Reader in Agricultural Economics in the University of Western Australia.

It is perhaps as important to know what "Farm Policy" intends to do in the future as much as what it has achieved in the opening number. Explaining the aims of the publication the Preface has this to say:

"Australia's farmers are taking an increasing interest in the social, political and economic affairs of agriculture. At present there is no journal or paper on these aspects of agriculture written especially for farmers. Consequently they have little opportunity of hearing from persons whose professional job it is to study these matters.

In recent years Australian Universities have been appointing such persons and many studies of concern to all farmers and farm families in Australia are now being made.

The purpose of this and subsequent "Farm Policy Bulletins" is to bring together some of the facts and ideas from these studies. For instance, in this number there are two articles on the Australian Dairy Industry written by University people who presented evidence to the Commonwealth Dairy Committee of Enquiry. Other numbers will deal with the marketing and Promotion of Wool, Rural Credit and Farm Development and so on.

It is hoped that farmers will come to regard this Bulletin as one of free, open and authoritative discussions." (Preface ends).

Certainly as far as economics is concerned it is encouraging to see that it is the intention of the bulletin to present the views of economists on some real problems.

Too often papers on agricultural economics are just theoretical exercises which are not related to any existing or probable situations and are therefore of interest only to the economists themselves.

One other aspect of this bulletin is interesting. The costs of printing and distribution of it have been borne by Westralian Farmers Co-operative Ltd. The

firm should have no cause to regret such a move if "Farm Policy" lives up to the aims it has set itself. The first of the four articles comprising the first edition of Farm Policy is "Australian Agriculture and Population" by Professor Bowen, Professor of Economics at the University of Western Australia. It is a quietly reasoned paper leading to the conclusion few agricultural scientists would quarrel with, that despite Australia's large land mass no significant extension of agricultural areas can be expected, unless through the use of as yet undiscovered new techniques. As a corollary it follows that if Australia's production is to increase it will not be in the country areas but in the cities.

The second paper is "The Australian Dairy Industry" by Dr. Schapper. A more topical agricultural subject could hardly be imagined. Dr. Schapper's argument is that the industry has too many farms with low net incomes and is over-supplied with labour. He suggests that this has come about because of the relative ease of entry into an industry in which a low capital outlay is needed, and where there is a short waiting time for the first receipt of income after purchase. After briefly examining and discarding the possibility that low net incomes could be corrected by increasing prices, or reducing costs he goes on to enumerate the defects of the present subsidy system. This is certainly an article that dairy farmers may not like but undoubtedly should read, for it contains many of the ideas that must be under consideration in politically high places at the present time.

The third article "Dairying — the case for Quotas" is by Dr. W. Candler, Senior Lecturer in Statistics at the University of New England. The problem of the dairy industry is discussed at the beginning mainly from the viewpoint of its effect on the national economy. The fact that some resources could be used more profitably elsewhere than in dairying it brought out, and the burden on the community of expanding dairy production is demonstrated in a simple and effective way. Dr. Candler proposes a quota system which in essence is a plan for gradually reducing the price paid to farmers for butterfat to the price it would bring on the export market.

Whether this is a plan which would be politically acceptable (if any plan for reducing income is ever politically acceptable) is in some doubt, but at the very least, it is an excellent framework on which to base further serious discussion. If the bulletin realises its aims there is every chance that this will happen.

The fourth article is "Improving Farm Management in Australia" by Dr. Schapper and M. L. Parker. The paper begins by distinguishing between technical advice and farm management advice — the latter being defined as being "to assist each farmer individually to identify and evaluate whatever alternatives are open, given his total farm resources and his farming goals."

The authors make the point that methods of mass communication are not well suited to farm management advice and suggest as the most likely remedy the formation of farm management clubs where one advisor advises 50-80 farmers. In the sense that the best advice is generally always disinterested personal advice they are right. There are nevertheless many

sound reasons given why farm management clubs should be encouraged and perhaps not the least of these is that it would offer potential agricultural students a career in a sphere other than in a State civil service.

Developing this theme further the authors suggest that several farm management clubs could join to form Farm Management Research Laboratories. The purpose of the laboratories would be to supply club advisors with the results of farm management research. Whether or not farm management clubs and farm management laboratories are feasible, or even at this stage desirable, will probably depend upon their ability to attract sufficient extra graduates in agriculture to staff them.

This bulletin has potential to be a most useful reference not only for farmers but also for agricultural scientists. More particularly perhaps, for those who work in some extension capacity where a well written authoritative article can be more convincing than a long verbal discussion.

L. E. COZENS

Diet in Relation to Reproduction and the Viability of the Young. Part III. Pigs

By D. L. Duncan and G. A. Lodge

Commonwealth Bureau of Animal Nutrition, Technical Communication No. 21 (pp. vii & 106).

Obtainable from the C.A.B. Liaison Officer at 314 Albert St., East Melbourne, C.2. Victoria.

Price 25s.

"This manual will be useful, both to the research scientist working with the domestic pig, and to the pig breeder. It is a review, concerned primarily with the reproductive physiology and nutritional requirements of the sow and her offspring. To their credit the authors have covered the early literature of the 1920's and 1930's as carefully as they have the more recent publications."

Chapter 1, the Introduction, is concerned with certain recognised criteria of productivity. Frequency of farrowing, size of litters, pig weights both at birth and at weaning, are some of the standards

considered. The information, culled from world-wide sources, should be of considerable interest to the farmer. To such it should come as a challenge that between 1932 and 1952 the standards required to merit a breeding certificate did not change noticeably.

In Chapter II the authors deal with certain aspects of reproductive physiology. It is evident that in this field much more work is called for. It would not be easy to translate the findings reported by Duncan and Lodge into practical guiding principles for the pig breeder, though this should, after all, be one of

the main aims of such research. It is evident that large gaps exist in our knowledge of subjects such as energy metabolism, water balance and sow-milk composition.

Chapters III and IV deal in turn with nutritional factors affecting the reproductive performance of the sow, then with the nutritional requirements of both growing pigs and the sow. Not enough emphasis has been placed on the qualitative aspect of protein intake. Work is quoted, for example, where 14 per cent protein in the diet is regarded as too high, while other workers have demonstrated an improved reproductive performance on raising the protein percentage in the diet from 15 to 17.5. Both the qualitative and quantitative aspects of such work needs to be considered.

Factors affecting sterility, ovulation, congenital malformation, growth of the foetus, litter size at birth, birthweight, and lactation, are discussed, sometimes too cursorily. Birthweight, for example, correlates strongly with chances of survival, and obser-

vation deserving close attention by nutritionists. The subjects of antibiotics and trace elements could have profitably occupied more space.

Chapter V dealing with the boar, is very brief; almost too much so. Since it has been repeatedly shown that the male of a species almost invariably suffers more during nutritional shortage than the female, it should not be overlooked by pig breeders. Viability may be more dependent on the nutritional state of the boar than we imagine.

Dr. Duncan and Dr. Lodge have produced an informative little volume. Their task was difficult, against a background of too little planned nutritional work with the pig. The abiding commercial importance of the pig needs no comment. But when the value of the domestic pig, as an experimental animal for nutritional problems in man, is being increasingly recognised, the cue given to this book to appear could not have been better timed.

W. IVES.

Bibliography of Soil Science, Fertilizers and General Agronomy 1956 - 1959

Commonwealth Bureau of Soils. 762 pp. Obtainable from the C.A.B. Liaison Officer at 314 Albert St., East Melbourne, C.2. Victoria. Price £5.

This unique triennial Bibliography, prepared by the Commonwealth Bureau of Soils, is now in its ninth volume. Nothing comparable with it is published for any other branch of science anywhere in the world. It covers every subject on which scientific research has been done connected with soils, the use of fertilisers and the cultivation of nearly 200 different crops and plants. Many ancillary subjects, such as plant physiology in connexion with soil problems, are also covered.

Between four and five thousand new papers on the subjects covered by the Bibliography are published each year. Nearly every paper probably contains some information required by some research worker investigating the same or a similar subject. A hitherto almost insoluble problem for the research worker has been to discover where, in this continually pouring torrent of new literature, is the information he requires. For the soil scientist this difficulty has been largely resolved by the Bibliography, in which some 14,000 papers, carefully classified according to subject, are referenced. The Bibliography includes, for

instance, some 300 references to soil organic matter and over 800 to soil physics. The user has only to open the book at the appropriate place (obtained from the subject index provided) and he has before him a complete bibliography of every paper of note published throughout the world in the three years. Each entry gives the name of the author, the title of the paper in English and the journal reference, and indicates the language in which the paper is written. Many entries also give the reference to where an abstract of the paper can be found in the Bureau's journal 'Soils and Fertilizers'.

Classification of entries is done by a decimal classification which is easy to use and is explained in an introductory Preface. The Bibliography also contains a key to the classification numbers used, an author index of 11,000 names and a list of some 1,500 periodicals, with place of publication, in which the items in the Bibliography were originally published.

W. IVES.

The Indigenous Livestock of Western and Southern Africa

By I. L. Mason and J. P. Maule

Commonwealth Bureau of Animal Breeding and Genetics, Technical Communication, No. 14, 166 pp., 179 illustrations and 2 figs., 3 maps. Obtainable from the C.A.B. Liaison Officer, at 314 Albert St., East Melbourne, C.2., Victoria. Price 56/3.

This book collates available information on the indigenous breeds of livestock in that vast area lying to the east and south of a line drawn from Northern Sudan to the mouth of the Congo. It deals with the following species. camel (5 pages, 5 plates), horse (5 pages, 5 plates), ass (3 pages, 2 plates), cattle (67 pages, 100 plates), sheep (21 pages, 44 plates), goat (12 pages, 20 plates), and pig (2 pages, 1 plate). The authors have gone to considerable trouble to classify animals according to a system which links

animals of similar type. Where available, measurements, liveweights and an indication of production are given but these characters are much influenced by environment. In classification and description, therefore, the authors "have concentrated on colour, and on morphological characters such as horns, humps, ears and tail.

This book is well produced and will become a standard reference for many years.

W. IVES.

Weeds:

The Farmers Handbook Series Compiled by J. N. Whittet

V.C.N. Blight, Government Printer, Sydney, 1958. Price 42s.

Estimates made in the U.S.A. indicate that the annual losses from weeds amount to three thousand million dollars, whilst in Australia losses are estimated to greatly exceed those caused by fungous diseases and insect pests combined. It is therefore to the benefit of the man on the land, as well as to the nation, to make concerted efforts to eradicate these pests.

The aim of this book is to point out this fact to the reader by means of examples, and to make him realise that weeds should not be tolerated on any progressive farm. Two chapters are devoted to a discussion of what constitutes a weed, the ways in which they are detrimental, the methods of spread and weeds typical of special habitats such as uncleared land, cultivation areas, irrigation channels etc.

One chapter is also devoted to poisonous plants and discusses the toxic principles of these plants and the effect they have on stock. The methods of weed control (Ecological, biological, mechanical, and chemical) are discussed and considerable information is given on the more common weedcides in use today, particularly the selective weedcides M.C.P.A., 2, 4-D, and 2, 4, 5-T.

Half of the book is taken up by descriptions and recommendations for control of most of the troublesome weeds found throughout Australia. This section should prove very useful for anyone desiring descriptions of weeds for identification purposes, but the recommendations given, in some cases, do not agree with those given in other States although this is probably due to different conditions in other States.

This book is the only comprehensive one of its size (404 pages) on weeds available in Australia and should prove of value to people interested in the subject. Being a volume in the Farmers Handbook series it is intended primarily for primary producers and is written in an easy to read, non-technical style. It contains very little technical information and because of this the more advanced student of weed control may be disappointed, but farmers, agricultural students, and people employed in the adminis-

tration of noxious weeds legislation will find in this volume a handy reference book.

It is copiously illustrated, containing 154 black and white and 82 colour illustrations and is practically free of printers errors. Several of the colour illustrations however, have not reproduced well. A section of 10 pages of photographs of weed seeds should be helpful in the difficult task of identifying the seeds of weeds.

T. W. DONALDSON.

THE UNIVERSITY OF SYDNEY
READERSHIP AND WILLIAM McILRATH RESEARCH FELLOWSHIP
IN ANIMAL HUSBANDRY

Applications are invited for the position of Reader in Animal Husbandry which has recently been established within the University of Sydney under a grant from the Commonwealth Scientific and Industrial Research Organisation. The successful applicant will also be appointed as William McIlrath Research Fellow. Research experience in a field dealing with the production, processing, and marketing of meat and meat products is essential. The appointee will be responsible, under the general direction of the Professor of Animal Husbandry, for the administration of the Meats Research Laboratory at Camden. He will be expected to conduct courses in Meat Production and Technology and to direct a major part of the research programme in the meats field, and in particular to undertake research in the problems of beef production from dairy herds. The salary will be £3,300 per annum, plus cost of living adjustments (at present £36 p.a.) and will be subject to deductions under the State Superannuation Act. Under the Staff Members' Housing Scheme, in cases approved by the University and its Bankers, married men may be assisted by loans to purchase a house. Applications, giving the names of three referees, should be forwarded to reach the undersigned, from whom further information may be obtained, not later than 19th May, 1961.

Sydney,
March, 1961.

M. A. Telfer,
Registrar.

The Grassland Society

Precis of Presidential Address, December, 1960. by R. D. CROLL, Foundation President to the Grassland Society of Victoria.

The President stated that it was with a sense of pride that he came to the task of presenting the first Presidential Address to the Grassland Society of Victoria, because he felt that a Society had been created which was not only needed but had in its short life done some useful work.

The President paid tribute to the Honorary Officers who had made the Society possible, in particular, our Secretary, our Treasurer and our Editor. He asked volunteers to assist the Editor in matters such as approaching authors, preparing proofs and making-up publications.

The President went on to analyse the principles upon which he and the Committee had based the activities of the first year. These were as follows:—

1. The Society should not tackle a programme beyond its means and that once established with a reasonable membership should grow naturally as a result of its achievements.

This principle is in contrast to building membership by pure promotion and seeking finance for activities not yet planned.

2. The major aim of the Society should be the dissemination of grassland farming knowledge wherever possible by publications so that even members who could not attend meetings would benefit from membership of the Society.

3. Publications should be authoritative, readable, presentable, and as concise as possible, rather than "glamorous."

4. In each year the Society should run two main events — a conference and a field day, and intersperse these with evening lectures and joint meetings with other Societies whenever appropriate lecturers are available. Availability of a suitable lecturer was considered more important than regularity of holding evening meetings.

5. Subscription rates should be kept as low as possible for as long as possible, and that if publications in a given year proved to be more costly than the Society could afford from its subscription funds, it would be better to make a charge for publication

(more to outsiders, less to members) than raise subscription rates at this stage.

6. Despite many offers of financial assistance from commercial firms, it was considered better to request actual payment of these donations to assist with specific projects, rather than to seek donations without having a specific application for them in mind. Support from the Commonwealth Bank is being sought as the Society's activities in developing agriculture would merit special action. It was further felt that too great a dependence on contributions from commercial firms could lead to unsound growth of the Society.

The President expressed the view, and sought discussion from members on it, that these principles had guided us well so far.

He went on to say that in the light of presumed acceptance of these principles, the future activities of the Society would be based on them. It was primarily a matter of selecting topics for our next conference and our next field day, and in respect of the former, the topic of Pasture Management has been tentatively chosen.

The President then asked the question "what else can we do to further the aims of the Grassland Society of Victoria?" and answered the question with two suggestions. He felt that the Society could and should produce a Grassland Handbook. This could become a manual of grassland practices, each section of which could be revised and brought up-to-date from time to time. To facilitate this, it would be sensible to bring it out in sections, punched for enclosure in a binding cover. In discussion, after the Presidential Address, members present agreed enthusiastically to this idea.

Wool Growing in the U.S.S.R.

Mrs. E. Cooper to Victorian Branch, 22nd July, 1960

In Australia there has been an increase from 113 million sheep producing 1,117 million lb. greasy in 1950-51 to 153 million sheep producing 1,670 million lb. greasy in 1959-60.

Science has made a tremendous contribution to the increase in wool production — with this year's wool cheque better than £400 million. We have of course had no really violent fluctuations due to

seasonal causes in the past ten years, but the expansion of the industry is due mainly to your having provided the "know how" for: Improved pastures, better animal husbandry, improved farm equipment, pest control.

Australia has ridden a long way and for a long time on the sheep's back. But what of the future? Our national expansion has produced increases in costs which, with the decline in wool prices, have made the cost-price squeeze a very tight one. Can we continue to grow wool at a price the consumer countries can and will pay for it? With this problem in mind it was very interesting for me to have a look inside the U.S.S.R.

Firstly I hoped I might learn something that would help me in my job of growing wool. I hoped in vain. A.I. is certainly practised with great success, but its use in our sheep industry is limited. Mr. Yessaulov (a member of the Council of the U.S.S.R. Ministry of Agriculture who led a delegation of Soviet Sheep breeding experts to Australia in October-November of last year) stated in his report published in a Soviet journal which is an important extension medium: "Australian sheep farming (including breeding methods, lambing, pastures, raising and feeding of sheep, watering, etc.) has a number of peculiar characteristics as a result of natural and economic conditions. Insemination of sheep is carried out in the natural way."

I thought sheep farming in the U.S.S.R. had a number of peculiar characteristics too. Much of what we saw was quite primitive. I was surprised to find that seven of the experts who accompanied us were quite unfamiliar with our normal practices. For instance it was difficult for them to grasp the idea of using gratings in a shearing shed. And a coloured snapshot of a sheep transport that I'd taken with me held them spellbound. In the same report Mr. Yessaulov wrote of his delegation's study of the techniques of Australian sheep farmers and of the achievements of scientific establishments. "There is something to learn, and something to copy." It had been obvious to us that they were great copyists. Another quote from his report: "The Soviet experts should take into consideration the experience of Australian sheep farmers in combining sheep farming with cattle raising and wheat growing in our planning of the development of sheep farming."

My second interest was the probable effect on the world wool market of the development of the U.S.S.R. internal economy.

We were treated as a very friendly delegation and there was, overall, an open exchange of views on the matters we discussed. I came back convinced that the Current Seven Year target of 1200 million lb.

wool (i.e. 6 lb. per capita) will be reached by 1965, and that they were quite serious when they told us they were trying to overtake Australia as the world's biggest wool producing country. By 1970 they expect to produce more wool than Australia does now. For those who want details there is an article on Sheep Farming in the U.S.S.R. published in the last Quarterly Review of Agricultural Economics. The possibilities of rapid growth at their present stage of development are very great. They are starting from a low base and can import the whole accumulated technology of the Western world without having to wait for the slow and tedious process of invention and experimentation.

They are possessed of rich resources and land largely undeveloped. Another 150 million acres are to be developed by 1965, and after that an intensification of pasture development is planned. Their labour force is more than adequate, they have good sheep now, and their use of A.I. is probably the greatest single factor that will help them increase sheep numbers and fleece weight. All the Stud Farms are State Farms and their Directors are graduates from one of the Agricultural Academies. We paid a visit to the Timiryozev Academy in Moscow. There is no faculty of Agriculture at Moscow University. The Academy has 6 faculties: Agronomy, Animal Husbandry, Soil Science and Agrochemistry, Fruit and Vegetable growing, Economics, and Agropedagogics.

I should imagine the only thing that could upset the Seven Year Plan with respect to wool production would be a change in National policy that deprived the Ministry of Agriculture of the wherewithal to provide the necessary machinery to grow and conserve in the summer, the fodder that is needed in the winter, and the necessary stabling. In the area where we were, sheep have to be stabled for about 6 weeks. The Directors of the State Stud Farms have a colossal job. They are paid 30 per cent more than the shepherds, and must get results. But I do not think for one minute there is any permanency in the wool demand from the Soviet Bloc, or from Red China — where A.I. centres are being established throughout the country, even in Tibet — to produce more wool. The expansion of Red China's wool textile industry is said to be without parallel. The cloth made is good and last year a considerable quantity of woollens and worsted was exported to the U.S.S.R. Of the other Asian countries, only in Japan can increased population be translated into terms of increased wool usage for reasons of climate, income, and the prior urgency of food requirements. We must look chiefly to our traditional markets — the higher income countries. The role of

Government is becoming increasingly important. Tariff walls affect price and so restrict wool usage and only Government can deal with that problem. The main challenge is to science.

A thriving wool industry — on which our present high standard of living depends — cannot be maintained without a great and continuous expansion of research into the problems both of increased and more economic production of wool and of wool usage. We must revise all previous conceptions of the resources that are necessary to ensure significant advances in both these fields. It is only logical that Australia as the world's biggest wool producer should take the lead in scientific enquiry into every phase of wool production, processing, and end-use. We must also formulate a more definite plan to extend scientific knowledge and implement improved techniques, and provide the "know how" to translate research activity into industry's advantage — not only in Australia, but in other countries also, as a means of improving world demand for wool.

What then of the effect of this rising production on the world wool market?

The physical power of the Soviet regime is so tremendous that it is not beyond the realms of possibility that this whole wool clip could be used to manipulate the world wool markets and create an economic depression in wool exporting countries. We were repeatedly asked "What will you do in a time of crisis?"

The normal expectancy is that it will be used to meet the wool needs of the people of the U.S.S.R.

Although the current Seven Year Plan provides for an increase in the output of cloth from 308 million linear yards in 1957 to 547 million linear yards in 1965, it could well be that the development of the wool textile industry is not high on their list of priorities. This could mean that the U.S.S.R. supplies the raw product to keep the wheels turning in Red China's flourishing wool textile industry.

Conferences

Rabbit Control

An interstate rabbit control conference was held in Sydney recently to exchange information and plan future tactics in the battle against the rabbit.

The conference was opened by Dr. F. W. G. White, Chairman of the C.S.I.R.O., and attended by senior rabbit control officers and research specialists from all States.

Reviewing progress since the last conference in 1958, Mr. F. N. Ratcliffe, Officer-in-Charge of the C.S.I.R.O. Wildlife Survey Section, emphasised that the chief feature of the rabbit control situation today was really of a psychological nature as rabbits in low or moderate numbers do not evoke an attitude of urgency, and landholders and others concerned with control grow complacent and tolerant.

Mr. Ratcliffe observed that myxomatosis had left a widespread, but generally light, infestation of rabbits throughout Australia, but because of virus resistance, the effectiveness of the disease would steadily diminish with time. As a result, Mr. Ratcliffe felt that it was reasonable to entertain the fear that unless the other methods of control were prosecuted vigorously, rabbit numbers would build up again, insidiously and progressively. He urged, therefore, that the next step in rabbit control should be a pilot-scale try-out of planned regional control.

A practical development of major importance over the last few years was the use of aircraft. Aerial baiting was now a well proven method of poisoning and it could give excellent results, Mr. Ratcliffe said. Time and labour saving are the valuable virtues of aerial baiting and the method also provides a way of tackling rabbits in difficult country.

The position in Tasmania and Western Australia

Mr. A. E. Hughes, Senior Vermin Officer of the Tasmanian Department of Agriculture, explained the history of control practices in his State. By 1957, he said, his Department was able to claim that the rabbit was no longer a serious problem in Tasmania. Since then, the Department has been engaged primarily in maintenance work to ensure that no recovery of numbers takes place. The key to success in Tasmania has been the thorough organisation of control campaigns on a district or area basis. This was made possible by a new Act which did away with local council responsibility for control and put it in the hands of a single central authority.

Mr. A. R. Tomlinson, Chief Vermin Control Officer of the Department of Agriculture, Western Australia, said that although the early drives against the rabbit in Western Australia were highly successful, lately the rabbit population had begun to increase steadily, but surely. This situation has arisen, he pointed out, because farmers have grown lax. They do not free-feed as diligently or run the trails as long as they used to do when enthusiasm to beat the rabbit was high. In some parts of the State, the only hope now of stemming the rising tide is by instituting a "killer" poisoning programme, Mr. Tomlinson said.

Points on Poisoning

Baiting materials most widely available throughout Australia were carrots and oats. Studies by the C.S.I.R.O. Wildlife Survey Section involving thousands of rabbits in different localities in New South Wales and in different seasons had shown that carrots are acceptable to 90 per cent of the rabbits all the year round. Oats, on the other hand, are only generally acceptable during the winter months. The results of other studies on poisoning added emphasis to the current recommendations about free-feeding. Shy-feeders are missed if the feeds are not repeated often enough. Lures as an aid to poisoning do not seem to warrant further study. Research has indicated that the rabbit's sense of smell probably plays only a small part in the location and selection of feed.

Other information about poisoning techniques has been gained through research on the social behaviour of rabbits. These studies direct attention to the importance of correctly placed poison trails. Rabbits form relatively small social groups and they avoid crossing certain territorial boundaries which would make them trespassers in the territory of the neighbouring group. If the poison trail, therefore, does not cut through all group territories, whole groups of rabbits are not exposed to the danger of picking up poison baits. Since these social groups tend to fall apart during the non-breeding months, furrow poisoning can give good results at this time. But in winter and spring, when the groups are closely defined, broadcasting of poison baits would be the more successful. With this method, baits are more likely to fall within the territorial boundaries of all groups.

Organizational Aspects of Control

Some weaknesses in the present system of organization of rabbit control were pinpointed in an address to the conference by Mr. T. L. Bull, a member of the New South Wales Rabbit Control Advisory

Committee. He considered that by reorganizing control measures, rabbits could be completely eradicated from large areas of the State. Some of these areas were as large as 300,000 acres where eradication could be obtained at a reasonable or low cost but under the present system nothing more can be done beyond pleading with individual property owners to kill the few rabbits they have. However, there is little incentive for them to do this, Mr. Bull said.

Mr. D. R. Stark, Pastures Protection Field Officer, Department of Agriculture, New South Wales, remarked that apart from the small number of properties where the owners, by unremitting labour, have always kept their holdings free of rabbits, the only real improvement in the rabbit position so far has been due to myxomatosis. The new rabbit poison, 1080, however, has proved most effective but its use in New South Wales has not been sufficiently widespread as yet to influence the overall situation. The greatest problem, Mr. Stark thought, was the indifference of most landholders to a small rabbit population — the seed of a future plague if myxomatosis fails to continue providing some measure of control.

Mr. J. Corbett told the conference that the Leichhardt Rabbit Board, Queensland, was charged with controlling rabbits over a vast area — comparable in size with New Zealand. Following attendance of Board members at the 1958 Melbourne Rabbit Control Symposium, the Board switched its policy from trapping and fumigation to modern poisoning methods based on 1080. As a result, over 100,000 acres have since been poisoned at a cost of about one shilling per acre. Funds to finance the Board's control campaign are raised by rating assessments on the unimproved capital value of the land. A graded scale has been used, the highest rate being 5/8d in the pound.

In the final paper presented at the conference, Mr. B. V. Fennessy of the C.S.I.R.O. Wildlife Survey Section, said that the once-a-year blitz on rabbits was not good enough. He pointed out that myxomatosis, in its weakened form, will only flare up when rabbits have reached damaging numbers and have already taken some toll of production and profits. Even in good myxo years a single epidemic is all that can reasonably be expected. Although poisoning with 1080 can give kills almost as high as myxomatosis when the disease was working at its best, farmers tend to poison only once a year.

He said that the sensible thing to do was to organize on a community basis so that rabbit numbers are kept as low as possible all the time. Complete eradication should be the objective in many areas. Increased investment in well co-ordinated campaigns

would pay off in increased production and higher profits. The New Zealanders have demonstrated one method by which this can be done. In their so-called "killer" system, locally elected Rabbit Boards take over the landholder's responsibility for control.

Mr. Fennessy ended his address with a plea to rabbit control organizations in the various States to formulate new objectives and re-organize where necessary to achieve them. Unless this were done the second century of the battle against the rabbit will end as dismally as the first, the centenary of which is being celebrated this year.

Mr. E. P. S. Roberts, Queensland grazier and member of the C.S.I.R.O. Executive, in summing up the discussions of the two days, said that it now seemed that there was enough knowledge to permit the rabbit to be controlled. The complacency of landholders, however, remained the major obstacle. Probably the best course to take was to set up Boards which would have the means and the responsibility for controlling rabbits and which would have total eradication as their ultimate objective. Experience has shown that trained field officers, under the control of a central authority, were needed. It was encouraging, he said, that in several States new forms of control organization were being tried and that new men and new ideas were giving the campaign new life.

Plant Quarantine

The implications for Australian Plant Quarantine of a new age of international transport and trade were discussed during a recent conference in Adelaide. The conference was convened by the Plant Quarantine Division of the Commonwealth Department of Health.

A report before the conference declared that Plant Quarantine would have to gear its services to meet the challenge posed by the greater volume and faster rate of air traffic to Australia.

It was stated that air passengers landed in Australia had more than doubled, and the amount of incoming cargo had at least trebled, in the past five years. Experts had suggested that international commercial aircraft would soon reach cruising speeds of more than 2000 miles an hour and that huge freighter aircraft would lift cargo from continent to continent at rates permitting the shipment of perishables such as fruit and vegetables.

The report emphasised that the procedure for inspection and clearance of plant materials would have to be reviewed so that a minimum delay occurred in the clearance of passengers and the turnaround of aircraft. Yet Plant Quarantine could not depart from its inescapable duty to thoroughly inspect all imported plant material.

The conference was convinced that Plant Quarantine safeguards must not be relaxed and re-affirmed the present policy of permitting nursery stock to be imported only by approved nurserymen and in quantities sufficient merely to establish a new variety. Delegates generally agreed that this policy had reduced the risk of pest and disease entry, especially of viruses and nematodes, by enabling Plant Quarantine to inspect importations more efficiently. This was in contrast to the days when bulk importations were allowed. The policy had encouraged Australian nurserymen to propagate new varieties in Australia.

Among the other items discussed were the isolation distances for nursery stock held in outdoor quarantine and the desirable specifications for insect-proof quarantine buildings. A proposal for the establishment of Commonwealth plant introduction stations was also discussed. It was agreed that while such stations would eventually be necessary, they would be premature at present, not least because of the shortage of expert staff. The present policy of having all imported varieties of commercial fruits

screened at centres where expert staff existed will continue meanwhile.

The conference closely examined methods of testing imported seeds and the standards set by both Commonwealth and State regulations. It was pointed out that the tendency overseas to export seed in sealed containers was creating inspection problems in Australia and that this question would require further study.

The danger of borers or Sirex Wood Wasp being introduced in all forms of timber, including logs, packing cases, furniture, toys and novelties was dealt with fully. The current policy of inspecting and treating where necessary all timber or articles containing timber which are capable of harbouring those pests was supported by delegates.

Detailed consideration was given to the treatments applied to quarantinable goods with the objective of achieving greater uniformity of methods throughout Australia and maximum efficiency of fumigation.

Many different categories of imports known or suspected to be capable of carrying plant pests, diseases or weeds were examined. They included straw packing, second-hand bags, bird seed, quick-frozen vegetables, plant products for processing, toys containing soil and second-hand motor vehicles.

The conference endorsed the present policy of regarding continuous publicity as an indispensable part of Plant Quarantine administration.

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*
(Greek — one who eats beside, or at the table of another or at another's expense).

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News Items

Canberra Phytotron

Construction of a new building, called a "Phytotron" has begun in Canberra.

A contract for the building, which will house unique research equipment, has been let for £263,450. It is expected that the building will be completed early in 1962.

The building will eventually be equipped with a hundred and forty specially designed glass cabinets in which various species of pasture and crop plants will be grown experimentally.

In each cabinet the temperature, light intensity and moisture content can be varied. In some of them the use of artificial light and shutters enables the length of "daylight" to be controlled. Without moving from Canberra scientists will be able to find out what climatic conditions are essential for the growth of our plants. They will also be able to study new species introduced from abroad and determine what localities in Australia will be suitable for them. And thirdly, plant breeders can attempt to breed plants suitable for the climate which prevails in any part of Australia, testing their experimental crosses in the artificially controlled climate cabinets.

Prototype glass cabinets and the engineering equipment to control the climate factors have been under continuous test since 1958 when the Commonwealth Government announced its decision to finance the project. Contracts for much of the equipment and the cabinets were let some time ago, and the engineering components will be ready at the time when the building is completed.

The Canberra phytotron will provide facilities similar to those at the California, Paris and Moscow phytotrons, but will have a number of unique features which enable a closer degree of control over the artificial climate conditions.

Grant for Pasture Experiments

A.C.F. and Shirleys Fertilisers Ltd. has given £500 to the C.S.I.R.O. Division of Tropical Pastures to assist in land clearing for further experiments at the Beerwah Research Station. The new experiments

represent the evaluation in replicated grazing trials of pasture mixtures showing promise for undeveloped coastal lowlands of southern Queensland.

A.N.Z.A.A.S.

A.I.A.S. visitors to A.N.Z.A.A.S. are invited to introduce themselves to the Queensland Branch President, who at the time will be Dr. G. Wilson of the Botany Department of the University of Queensland.

New Deputy Director in W.A. Department

Mr. F. L. Shier has been appointed to the position of Deputy Director in the Western Australian Department of Agriculture, which became vacant when Dr. T. C. Dunne was appointed Director some time ago. Mr. Shier joined the Department as a cadet in 1922, and became an agricultural adviser in 1926. One of the best-known agricultural scientists in this State, he has been Superintendent of Wheat Farming since 1954.

New Buildings for W.A. Department

The last sections of the Western Australian Department of Agriculture have now moved to the Department's new buildings at South Perth. This completes the programme for the Department's headquarters, and makes it perhaps the best housed of the State Departments. Other agricultural bodies are also expanding. The University Institute of Agriculture is having a new wing added to the present building, and a small extension has recently been added to the C.S.I.R.O. buildings in the University grounds.

Visiting Professors

C.S.I.R.O. Division of Plant Industry report that the following professors will spend some time at their Canberra laboratories this year:

Professor Samuel G. Wildman, of University of California, Los Angeles, will spend 9 months from January 1961 at Canberra on a Fulbright award. He is distinguished for his work in plant viruses, and will co-operate with Dr. L. A. T. Ballard in plant physiology research.

Professor H. N. Barber, Professor of Botany, University of Tasmania, will spend his sabbatical leave in Canberra during 1961. He will work with Plant Physiology and Genetics sections, continuing his investigations on flowering time in peas, and also will spend some time with Professor L. D. Pryor, Professor of Botany, School of General Studies, Australian National University.

Dr. D. Heinrichs, Head of the Forage Crops Section, Research Branch of the Canadian Department of Agriculture, with headquarters in Swift Current, Saskatchewan, will spend 1961 with the Genetics section under the Canadian system of transfer of duties. He is noted for the development of creeping rooted lucerne.

Quarantine Films

Two new 16 mm. colour films produced for the Plant Quarantine Publicity Campaign will be ready for release throughout Australia early in 1961. These latest high-standard productions will give the Campaign a "library" of eight films, four of them in colour. The new films are titled "Plant Quarantine at Work" and "Dangerous Immigrant."

"Plant Quarantine at Work" embraces, for the first time in one film, the broad field of Plant Quarantine operations in halting the infiltration of overseas plant pests and diseases. The Commonwealth Film Unit's cameras take the viewer on a conducted tour with the Plant Quarantine inspectors to the airports and wharves where overseas passengers luggage is checked for plant materials; to the bustling wharfside warehouses where a relentless search goes on for quarantinable goods; to the mail-sorting rooms where plants are intercepted in parcels; to the sawmills where a sharp lookout is kept for borers and other insects as imported logs are sawn, and to the quieter atmosphere of the seed-testing laboratories and the glasshouses where nursery stock is handled. The film is a convincing reminder of the grim reality of the pest and disease threat to Australian agriculture and the necessity for unyielding defensive action by Plant Quarantine.

"Dangerous Immigrant" is a film about the European House Borer, which reached Australia with

post-war shipments of prefabricated houses. If allowed to spread, this insect could become a greater menace than the White Ant. The purpose of the film is to enable people to recognise the borer and report its presence, so that quick eradication may be taken. The film has outstanding life history sequences. There are also novel sound effects — a recording of the grating noise made by the House Borer while chewing in a piece of timber. This noise disturbed the tenants of an infested house in Melbourne and led to the first discovery of the insect in Victoria.

U2 Planes and the Weather

An Australian scientific theory on how rain is formed has gained strong support from scientific measurements made by the recent American U-2 flights.

Rainmaking research has shown that clouds are likely to form rain when there are large numbers of tiny, solid particles in the atmosphere of the clouds. Each one of these particles becomes a nucleus for the formation of ice crystals which subsequently melt and become raindrops.

One unsolved mystery is the origin of the host of tiny particles which are found from time to time in the upper atmosphere. They may be dust particles thrown up from the ground. But Dr. E. G. Bowen, Chief of the C.S.I.R.O. Division of Radiophysics, believes that they may originate from meteor showers which fall into the earth's atmosphere from outer space.

One test of their origin is to measure their number at different heights in the atmosphere. If they come from the ground they will decrease sharply in number as the height increases and very few will be found at heights above thirty or thirty-five thousand feet. If they are coming from outside the atmosphere however, there should be just as many at great heights as low down.

The arrival of the high-flying U-2 planes in Australia provided a unique opportunity to test the meteor theory. These flights showed that considerable numbers of these particles exist up to heights above sixty thousand feet. This lends support to the suggestion that they are coming into the atmosphere from outer space.

To test the theory further, it is hoped to make measurements up to one hundred thousand feet,

probably by means of balloons, and to try to obtain the chemical identification of the particles. In this way their nature and origin are gradually being revealed.

Insect Collection

A well-known authority on Australian bees, Mr. Tarlton Rayment recently handed over his valuable collection of Australian bees, wasps, thrips, and mites to the C.S.I.R.O. These will be added to the comprehensive collection of the Organization's Division of Entomology and will become part of the national insect collection.

Mr. Rayment has studied bees for many years, and has described a large number of new species. He has earned world-wide recognition as an authority in this group of insects, both for his work in classifying the Australian species and for his interesting studies on their biology.

His collection contains many type specimens which are of vital importance as the ultimate reference point when the identity of a specimen is in doubt. The Division of Entomology has the responsibility of carrying out an increasing amount of work on insect systematics, for Australian entomology is seriously hampered by lack of means for recognizing many native insects.

Pisatin

A discovery which may revolutionize the struggle against the fungus diseases which attack our crops was announced recently at the International Symposium on the Chemistry of Natural Products.

Dr. D. R. Perrin and Dr. W. Bottomley of the C.S.I.R.O. Division of Plant Industry, told a meeting of the symposium of the discovery of Pisatin, a substance produced by plants in response to fungal infection.

Now that the chemistry of the first natural disease resistance substance of this kind in plants is known, a new field of research is opened. It may be possible to produce chemicals similar to Pisatin which can be used to spray plants to protect them from plant diseases. C.S.I.R.O. scientists are very interested in the possibility of producing fungicides which, like anti-biotics in humans, might spread throughout the whole of plants and give complete immunity to disease.

Pisatin is chemically quite different from the antibodies which protect animals from many diseases, but may be the first example of the anti-body equivalent in plants.

Soviet Science in English Catalogue 1960

The catalogue describes the works produced by the *Israel Program for Scientific Translations*.

The program has been inaugurated for the purpose of providing English translations of recent and important Russian books and articles in all branches of science. The material to be translated has been selected by departments of the American Government as transferred to Israel by the National Science Foundation, Washington, and the *Israel Program for Scientific Translations* has been entrusted with the sole distribution (outside the U.S.A.) of this material.

Additional information and copies of the catalogue may be obtained by writing to Program for Scientific Translations, 14 Shammai St., Jerusalem, Israel P.O.B.7145.

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Personal Notes

Australian Capital Territory

Dr. F. H. W. Morley and *Dr. J. B. Griffing* have been invited to speak at the Plant Breeding and Genetics Conference to be held in March, 1961, at Raleigh, North Carolina, U.S.A. They will be accompanied by *Dr. B. D. H. Latter*.

Dr. J. F. Loneragan will leave C.S.I.R.O. Division of Plant Industry early in 1961 to take up an appointment as Senior Lecturer in Soil Science at the Institute of Agriculture, University of Western Australia.

Dr. R. C. Rossiter, officer-in-charge of C.S.I.R.O.'s Western Australian Regional Laboratory, and his colleague *Mr. E. R. Watson*, officer-in-charge of Glen Lossie Field Station, Kojonup, W.A., each visited Canberra for some weeks late in 1960.

Mr. J. G. Bird has transferred from the Bureau of Agricultural Economics, Canberra, to join N.S.W. Department of Agriculture at Lismore. He is engaged on a project involving economics of dairy farming, sponsored by the Australian Dairy Produce Board.

New South Wales

Dr. Lillian Fraser was appointed some months ago to the position of second in charge of N.S.W. Department's Biological Branch now situated at Rydalmere. Dr. Fraser is the first woman to be appointed to such a senior position in the N.S.W. Department. Her interests are in pathology of citrus and grapes.

New graduates with the Biological Branch of the N.S.W. Department are *Ray Pares* who will be working on fruit virus diseases, and *Alan Smith* who will be concerned with cereals.

Dr. R. J. Noble, recently retired Director of the N.S.W. Department, has been appointed to the committee of enquiry on the sugar industry.

Dr. W. V. Single formerly plant physiologist at the Wagga Institute has been appointed Director of the previously dormant Tamworth Agricultural Experimental Station.

Mr. W. J. C. Hudson who was manager of the Agricultural Experiment Farm, Wollongbar, is now Supervisor of Dairy Industry Research for the far north coast of N.S.W.

Mr. F. F. Filan is now Senior Agronomist on Seed Production of the Department and is responsible for certification and multiplication of new species and strains of pasture seeds.

Dr. M. C. Franklin, well known C.S.I.R.O. authority on animal nutrition, is moving headquarters from Sydney to the Cunningham Laboratory in Brisbane where he plans to start a physiology unit attached to the Division of Tropical Pastures.

Mr. C. D. Blake, formerly with the Department at Murwillumbah, has been awarded a Benjamin Fuller Scholarship which he is taking up for two years at the Department of Nematology, Rothamstead.

Mr. D. B. Muirhead has left C.S.I.R.O. Armidale to take up a position with the Australian Meat Board in London.

Miss B. Ogilvie, the first woman graduate from the Faculty of Rural Science at the University of New England, and top of her year, is now working at the School of Veterinary Medicine, Cambridge.

Queensland

Professor Teakle of the University Department of Agriculture attended the Pan Indian Ocean Science Association Congress in Karachi on November 15. He was a member of the four-man delegation from Australia and spent two days in Bangkok and three days in Delhi before the Congress. The theme of the Congress was "Food."

Dr. J. Griffiths Davies, Chief of the C.S.I.R.O. Division of Tropical Pastures returned from his overseas visit to Europe and the Americas in December. In addition to leading the Australian delegation to the 8th International Grassland Congress and attending the Commonwealth Agricultural Bureaux Conference in England, Dr. Davies visited a large number of research centres in central South America, the United Kingdom, Europe, and the U.S.A.

Mr. W. W. Bryan and *Mr. N. H. Shaw* of C.S.I.R.O. Division of Tropical Pastures are leaving Australia in April on long service leave. Both will tour the United Kingdom and Europe with their wives, and plan to visit some pasture research establishments en route.

Mr. T. Bowen of Henry York recently visited Germany, France, Holland and England in connection with development of agricultural chemicals.

The Department of Agriculture delegates to the 8th International Grassland Congress held in Reading, England, in May returned to duty in Queensland in late October. *Mr. S. Marriott* returned via Jamaica, South U.S.A., and Hawaii, whilst *Mr. R. Humphreys* came via Kenya, Southern Rhodesia, South Africa, Perth, and the Waite Institute.

Mr. J. G. Young, of Cattle Husbandry Branch of the Department of Agriculture visited New Zealand on a Commonwealth grant investigating methods of milk production.

Mr. S. Everist, Government Botanist, *Mr. W. J. Bissett*, Agrostologist, and *Mr. F. Ward*, Sheep Husbandry Officer, were State Department of Agriculture delegates to the Arid Zone Conference held at Warburton, Victoria, in December.

Australian Estates held a school for their Sheep Property Managers at Terrick Station, Blackall, in September. *Messrs. S. Everist, W. J. Bissett*, and *R. G. Wilson* of the Department of Agriculture and Stock gave technical assistance.

Dr. D. O. Norris and his wife recently returned home from their round Australia trip. They said that the highlight of their trip was the Centre. Although on holiday, Dr. Norris sent back quite a few nodules and made a number of contacts with agricultural scientists in various parts of the Commonwealth.

Dr. Brett, a sugar cane breeder from a research station 12 miles out of Durban, South Africa, visited the Cunningham Laboratory recently. Dr. Brett is interested in developing sugar cane varieties adapted to relatively poor soils and a sub-tropical climate. *Mr. W. P. Dunk*, Chief Irrigation Officer, State Rivers Commission, Victoria, visited the Cunningham Laboratory at the end of October and attended an irrigation conference while in Brisbane.

Mr. Lloyd-Jacob of Fisons Fertilisers Ltd., England, also visited the Cunningham Laboratory and discussed the potential usage of nitrogenous fertilisers in the summer rainfall areas of Australia. There have been a number of chemical firms interested in the possible use of nitrogenous fertilisers, particularly on tropical pastures. It appears that eventually the cost of nitrogenous fertilisers will be reduced sufficiently to make their application to pastures economic.

South Australia

Mr. K. W. Shepherd, Genetics Department, University of Adelaide, has been appointed a wheat geneticist in the Wheat Breeding Section of the Agronomy Department to work in connection with the Wheat Industry Research Fund. He is expected to take up duties on the completion of his Ph.D. work.

Mr. T. C. Miller, Chief Horticulturist, Department of Agriculture, will act as Assistant Fruit Officer in the U.K. in the Commonwealth Department of Primary Industry. He will assist the Supervising Officer in London to inspect and report on the out-turn of Australian fruit. His appointment will be for the duration of the 1961 export season. He has also planned to inspect the fruit industry on the Continent and in the United States.

Mr. J. B. Doolette, formerly Officer-in-Charge at Turretfield Research Centre, Department of Agriculture, has been appointed Barley Agronomist in the Department.

Mr. N. S. Tiver, Chief Agricultural Adviser, Department of Agriculture, after attending the Eighth International Grassland Congress at Reading, England, spent Christmas in California where he was joined by his family.

Messrs. B. K. Taylor and *D. H. Simons* have completed their Honours Degree in Plant Physiology at the Waite Institute. Mr. Taylor will take up an appointment with the Victorian Department of Agriculture at the Tatura Research Station, near Shepparton. Mr. Simons has joined the Horticultural Branch of the South Australian Department of Agriculture.

Tasmania

On a recent long-service leave trip around Australia, *Mr. D. Paton*, Senior Agronomist with the Tasmanian Department of Agriculture, spent a fortnight with agrostologists of the W.A. Department of Agriculture.

Mr. B. Pyke has transferred from his position as Animal Husbandry Officer with the Animal Health Service of the Department of Agriculture to the position of Bacteriologist with the Dairy Division.

Victoria

Mr. W. Parsons, Senior Research Officer, Department of Lands and Survey, returned recently from the U.S.A. and Europe where he investigated all aspects of weed control. His 11 months stay in the U.S.A. was under the auspices of a Commonwealth Fund Fellowship.

Mr. B. F. McKeon, Senior Technical Executive Officer, Department of Agriculture, spent three months at the Administrative Staff Training College, Mt. Eliza.

Mr. R. Farqhar, Agricultural Research Liaison Section, C.S.I.R.O., has returned from U.S.A. where he carried out post graduate study in Extension Organisation.

Dr. F. R. Hird, Reader in Agricultural Biochemistry, recently returned from sabbatical leave. He spent six months working at the Biochemistry Department, Oxford, and several months in Copenhagen. Dr. Hird returned by way of the U.S.A. where he lectured at several universities.

Dr. E. Fisher, Senior Plant Pathologist, Department of Agriculture, recently visited New Zealand and the U.K. While abroad she investigated the facial eczema problem. Facial eczema is at present occurring in parts of Victoria.

Five Agricultural Extension Officers of the Department of Agriculture have now been appointed to districts. They have been trained under the Department's scholarship scheme, financed by the Commonwealth Extension Services Grant.

They are:—

Mr. B. Crouch, Bendigo.

Mr. J. Avery, Euroa.

Mr. P. Finlayson, Sealake.

Mr. M. Cook, Colac.

Mr. F. Barkla, Swan Hill

Other officers are at present stationed in the country for in-service training and will be appointed to districts at some future date.

Western Australia

Mr. G. K. Baron Hay, recently retired Director of Agriculture, has agreed to take up a position as adviser to the State Government on development in the North-West of Western Australia.

Mr. R. Morris, Officer-in-Charge of the Poultry Branch of the Department of Agriculture, has left for Patna, India, where he will work for about a year under the auspices of the Colombo Plan.

Mr. M. Cullity, Superintendent of Dairying in the Department of Agriculture, is spending his long service leave in England and Europe. *Mr. H. Elliot* will be in charge of the Dairying Division in his absence. *Mr. W. Blackmore* of C.S.I.R.O. has arrived from Adelaide to continue his work in soil physics at the Western Australian regional laboratory.

Dr. M. Mulcahy, of C.S.I.R.O., has left for an extended study period in the U.K. He was recently awarded his Ph.D.

Mr. B. Purser has left the University Institute of Agriculture to continue his rumen microbiology studies in the U.S.

Mr. M. Somers has also left the Institute's rumen microbiology group to take up an appointment at the New England University, N.S.W.

Professor G. Hallsworth, visiting Professor of Soil Science at the Institute of Agriculture for the past year, has returned to England.

Dr. J. Loneragan has arrived to take up his position as Senior Lecturer in Soil Science at the Institute of Agriculture.

Branch Notes

New South Wales

Branch concern about soil and plant analysis services, now being provided commercially, was ventilated at a Symposium "Is Soil Analysis Useful as a

Diagnostic Technique," held in October and attended by 50 people. Professor Collis-George of Sydney University talked about "Common Pitfalls in Soil Analysis for Advisory Purposes" and Mr. C. H. Williams, C.S.I.R.O., Canberra, debated "Can Successful Soil Tests be Developed for Australian Conditions." Representatives of Dalgety and Co., who

provide an analysis service, attended by invitation, but did not contribute to the discussion. The meeting received a wide press coverage. The place of meeting was the new branch headquarters at Agriculture House, Macquarie Street, and the addresses were preceded by a buffet tea. Members should note this new address of the Branch.

An Institute activity of great potential importance was suggested by the president elect Dr. Brian Davey, at the Jubilee dinner. He proposed the Institute should press for establishment of an Australian equivalent of the British Agricultural Research Council, which administers British agricultural research funds.

N.S.W. Newsletters have taken on a new look; the first page now has a printed head, but the increased cost is more than offset by registration for transmission by post as a periodical. Six letters are to be published yearly.

Activities for 1961 are under discussion at the Committee level and a residential seminar is being considered. It is also hoped to institute discussion groups during the current year. The committee reports a substantially improved position in regard to subscriptions; this is due mainly to the efforts of the Treasurer, Dick Jackson.

Queensland

The ordinary general meeting of November 2 was held in the Cunningham Laboratory of the C.S.I.R.O. at St. Lucia. The evening was devoted to a discussion on Sugar. Three speakers addressed the meeting:

Mr. L. Brain (Bureau of Sugar Experiment Stations): Sugar — its byproducts and uses.

Mr. J. Clayton (Cane Prices Board): The Privileges and Penalties of Cane Growing.

Mr. L. Woods (Australian Sugar Producers Association): Sugar Marketing.

The last ordinary general meeting of 1960 was also held in the Cunningham Laboratory of C.S.I.R.O. and was devoted to presentation of papers by the finalists for the A. F. Bell Memorial Medal. This Medal is awarded annually by the Branch for the best research project carried out by an agricultural student in his third or fourth year of the course at Queensland University. The projects are written up as short papers and three finalists are selected and invited to present their papers to the November meeting.

The finalists for 1960 and the titles of their papers were:

Mr. D. R. J. Densley: The Effects of Various Mulches on Potato Yields.

Mr. L. A. Douglas: Nitrification Studies on the Waco Series of Darling Downs Black Earths.

Mr. D. L. Purcell: The Effect of Nitrogen and Sulphur Singularly and in Combination on the Growth of an Introduced Pasture of Green Panic, Rhodes Grass, and Legumes.

Dr. E. M. Hutton, on behalf of the Selection Committee, awarded the Medal to Mr. L. A. Douglas, and the presentation was made by Mrs. Bell.

South Australia

At a meeting, held on December 9, two films were shown. Mr. H. F. Lower, Entomology Department, Waite Institute, led discussion on "The Biological Control of Insects" and discussion on "Man against a Fungus" was led by Dr. N. J. Flentje, Plant Pathology Department, Waite Institute.

Tasmania

At the 97th General Meeting on November 25, 1960 the By-Laws were amended to create the position of President-Elect whilst retaining the office of Vice-President. The amendment is designed to enable the election as Vice-President of a member not resident in the centre of management of the Branch and thus facilitate the holding of formal meetings elsewhere, particularly in Launceston.

The speaker at the 98th General Meeting on November 25, 1960, was Mr. C. A. Holland, Chief Extension Officer of the Tasmanian Department of Agriculture. Mr. Holland gave an introductory address on "Agricultural Education in Tasmania," dealing with the development of the State's Extension Service and then invited discussion, with particular reference to the merits of an Agricultural College as compared to a Faculty of Agriculture, on improving Tasmania's agricultural production.

Victoria

The annual welcome to new graduands was held at the School of Agriculture on December 9. It took the form of a garden party, with a buffet tea being served on the lawns.

The President, Mr. H. R. Dickinson, presented the Branch prize to Mr. R. A. Fischer, who topped the final year. Mr. Fischer achieved the distinction of gaining honours in six final year subjects, four of these being first class honours. Mr. Fischer is now with the New South Wales Department of Agriculture at the Wagga Research Institute.

During the evening thirty graduands applied for corporate membership of the Institute.

Looking to the coming year the activities sub-committee is preparing a programme of interest to all members. It is hoped that a number of joint meetings may be held with affiliated societies.

Western Australia

As a result of the recent big drop in prices of nitrogen fertilisers, the Western Australian Branch has set up an expert sub-committee to "review and collate relevant local research results on the use of nitrogen fertilisers, on the basis of improved cost structure, and in the light of the foregoing studies to appraise the scope for greater use of nitrogen fertilisers in this state."

This motion was agreed to at the November meeting, and the subcommittee — Mr. F. J. Roberts and Mr. E. Greenwood of C.S.I.R.O., and Mr. N. Fitzpatrick and Mr. J. Toms representing the Department of Agriculture, has started work on what promises to be a long and difficult but rewarding job. They will have to sift through results of hundreds of experiments (many of them unpublished) which have been disregarded because of the high cost of nitrogen fertilisers, but which could now lead to economic use of these fertilisers in many places. Wider use of nitrogen fertilisers has already resulted from work by the Department of Agriculture, particularly with crops on new light soils in this State.

Farm management clubs, or farm advisory services, are rapidly increasing in number in Western Australia, and have posed a new problem for the Institute. Obviously it would be desirable for the advisers appointed by these clubs to have University training, but, partly because of the shortage of graduates, the advisers appointed so far have all been New Zealand agricultural college diplomates.

This has caused some misgivings because firstly, if future diplomate appointees do not come up to the standard set by the first advisers appointed (capable young men with experience in similar services in New Zealand) this could hamper further development of the farm management club movement, and

secondly, if this trend continues it could close a possible alternative employment avenue for graduate agricultural scientists.

At the January meeting Dr. H. P. Schapper, who initiated the movement in Western Australia, was asked to address members on "Farm Management Advisory Services and the A.I.A.S." and put his viewpoint on the present position. His talk aroused wide discussion, but no agreement was reached on any future policy or what part the Institute should take in the farm club movement.

The fourth annual Farmers' and Scientists' Joint Conference was held at the University from February 14 to 16. The conference was as successful as the previous three, but A.I.A.S. members feel that four conferences in a row is quite enough and the branch will not agree to take part in one next year.

The Grassland Society of Victoria

Founded in December, 1959, the Grassland Society of Victoria has completed its first year of activities with a membership approaching 300. Of this number, some 50 per cent are farmers, the other 50 per cent comprising scientific and technical people with a wide range of interests in pasture development.

The objects for which the Society is established are:—

A. To provide opportunities for those interested in and concerned with grassland husbandry to meet and exchange information, ideas and experiences relating to all aspects of grassland management, production and utilisation.

B. To encourage the investigation of problems pertaining to grassland husbandry.

C. To stimulate the incorporation into practice of advances resulting from research, experimental work and practical experience.

D. To produce such publications as may be considered desirable.

E. To co-operate with any other organisation in furthering any of the objects of the Society.

F. To do any things as may be conducive to the attainment of the above objects or any of them.

The Society is affiliated with the Australian Institute of Agricultural Science.

THE 1960 PROGRAM

Conference: A conference built around the theme "Phosphate — its role in Victorian pastures" was the first function to be held. A series of papers on aspects of phosphate usage followed by a period of questions and discussion provided a high degree of interest for the 160 people who attended.

The conference was held in May, a time considered to give most farmers the opportunity to attend. It is anticipated that this autumn conference will become an annual feature of the Society's calendar.

Field Day: The other major function was a Field Day held in the Alexandra district, some 90 miles North East of Melbourne. Visits were made to two properties of differing nature where aspects of grassland management were studied and discussed.

The Field Day was of one day's duration which enabled a larger attendance by farmers at a busy time of year for them.

Evening Lectures: Two evening lecture meetings were held during the year to hear from visitors to the State with an interesting story to tell.

Annual Meeting: The first annual general meeting was held in December when following the business meeting the President, Mr. R. D. Croll spoke on the Society and its future. A summary of this address appears in the talks section.

Publications: The Society's major publication in 1960 was a summary of the conference proceedings. This includes summaries of all papers given and a precis of discussion. A limited number of copies are still available on request to the Secretary.

A quarterly newsletter was produced which kept members posted on Society activities. A report on the Annual Field Day was included in the December issue.

Publications are considered to be a major activity of the Society and in furtherance of this policy a committee has been formed to plan and produce the Society's publications. This will permit some expansion to take place in the scope of published material. A quarterly Bulletin is being planned to provide a concise presentation of information about grassland farming.

A further objective is the production of a Grassland Farming Handbook.

1961 Conference: Plans are already well advanced for the Society's second conference to be held on May 22-23 this year. It will have as its theme "Some Aspects of Pasture Management" and will be held at the Burnley Horticultural College, by courtesy of the Director of Agriculture. The Society's Annual Meeting will also be held at this time.

In retrospect there seems no doubt that in its first year the Society fulfilled its founders' hopes. It has become apparent that it can play an important part in providing a forum where all those with grassland interests can meet together. In particular it can help to bring a greater understanding between farmer and scientist, the lack of which is often only for the want of a common meeting ground.

All who are interested in grassland activities will find that the modest subscription of £1/1/- per annum would be well worth their while. The Society would be glad if they would encourage others to join.

The formation of Branches in country centres is, in the long turn, regarded as vital to the success of the Society. It is hoped that 1961 will see the beginning of this phase of the Society's development.

The Society can be justifiably proud that its activities have been considered important enough to be worthy of support by a Commonwealth body, namely the Reserve Bank of Australia.

The Society gratefully acknowledges a grant of £400 from the Rural Credits Development Fund of the Reserve Bank of Australia, the sum to be made available during 1961 and 1962.

The Grassland Society of Victoria looks forward to the day when similar societies may be formed in other States. The formation of an Australia wide organisation could then be contemplated.

Inquiries concerning the Grassland Society of Victoria should be directed to:

The Secretary,
226 Clarendon Street,
East Melbourne, C.2.

Obituary

DUNCAN CAMPBELL SWAN

With the death, in London, of Duncan Campbell Swan in December last, Australia has lost one of its best-known entomologists.

Born in Perth, Western Australia, in 1907, he obtained his tertiary education at the University of Perth where he received his Honours Degree in Science.

Soon after, he was appointed Lecturer in the Entomology Department of the Waite Research Institute where he later became Senior Lecturer. In 1935, he was awarded the degree of Master of Science by the University of Adelaide.

On the outbreak of the Second World War, he joined the R.A.A.F. Medical Section in 1942. At the time of his demobilisation four years later, he had attained the rank of Flight Lieutenant.

Two years after his return to the Institute, he was appointed Reader in Entomology and Head of the Department, a position which he has occupied until his death. Under his wise and sympathetic guidance, the Department made enormous progress.

Scientifically, he will be best remembered for his work on locusts, and on the grape *Phylloxera*. He was one of the first in Australia to appreciate the importance of first-hand knowledge of the breeding places of locusts, and his repeated surveys of the arid northern regions of South Australia gave him a background of information which has been constantly drawn upon by his successors. He was the Australian authority on *Phylloxera* and was consulted by workers on this species from all parts of the world.

To his many friends he will be remembered as a gentle, kindly adviser, and a true friend whose first thoughts were always for others, never for himself.

R. G. THOMAS

The death occurred at his home on Thursday, January 5, 1961, of Mr. R. G. Thomas at the age of 62.

Since 1953 he had been a Member of the Soil Conservation Authority of Victoria, and he had been appointed by Cabinet to become Deputy Chairman in February. His passing is a great loss to soil conservation in Victoria.

A graduate of Dookie and Longerenong Agricultural Colleges, he graduated from the Melbourne University in 1921 with final honours in Agriculture and Agricultural Engineering. He obtained his Master's degree in 1926.

Joining the Department of Agriculture as Science Field Officer in 1921, he was promoted to Manager, State Farm, Rutherglen, and later to Inspector of Agriculture. He resigned from this position to take up wheat farming and fat lamb raising in the Greenhills district of Western Australia.

Returning to Melbourne in 1943 he was appointed Technical Officer to the Soil Conservation Board. When the Board was replaced by the Soil Conservation Authority in 1950, he was the Executive Officer prior to his appointment as Member.

An untiring, persistent and precise worker of outstanding ability, his modesty and quiet, friendly manner won him the respect and friendship of his colleagues and many people throughout Victoria.

He was largely responsible for the growth and sound development of the extension services of the Authority, and the annual soil conservation competitions held throughout the State owe their unquestioned success largely to his understanding of the farmer, and his organising ability.

He is survived by his wife, daughter and two sons, to whom the Institute offers its sympathy.

RICE

In 1960 Australia produced an average of 2.55 tons per acre of rice from 47,000 acres. In the previous season, the world's highest production over an entire crop of upland rice, 4.3 tons per acre, was recorded.

Commercial production first began in the Murrumbidgee Irrigation Area in 1924, following unsuccessful attempts on the North Coast of New South Wales in 1891. Initial yields were of the order of one ton per acre.

Until now, rice production has been confined to the Murrumbidgee Irrigation Area and adjacent areas but much effort is at present being expended to further develop S.E. Asian long-grained varieties in the Northern Territory and Kimberley regions, and a small commercial crop was harvested in the north in 1960.

A plentiful supply of nitrogen is essential for high yielding rice crops, as one ton of paddy removes about 32 lb. of nitrogen or the equivalent of almost $1\frac{1}{2}$ cwt sulphate of ammonia. The results of experiments conducted during

the early 1930's showed consistently profitable increases in yields with sulphate of ammonia, up to an extra 16.5 cwt. of paddy per acre being obtained with dressings of $1\frac{1}{2}$ cwt.

Today's high yields reflect the closer attention now being paid to building soil fertility through pasture leys in the rice rotation, and the judicious use of fertilisers. Sulphate of ammonia — the most popular nitrogen fertiliser for rice — is applied at rates varying from $\frac{1}{2}$ cwt. to 4 cwt. per acre, depending on the past history of the paddock and the soil type. The former rate is indicated to assist establishment following 6 or 7 years of good clover growth on land where the fertility has been built up over many years. On the less fertile soils in the newer rice growing districts, up to 4 cwt. has been proved very profitable.

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THE UNIVERSITY OF SYDNEY SENIOR LECTURESHIP IN HORTICULTURE

Applications are invited for the position of Senior Lecturer in Horticulture in the Department of Agriculture. The successful applicant will undertake teaching and research in fruit and vegetable production. His teaching duties will be partly at the post-graduate level. The salary for a Senior Lecturer is within the range £2,500-x95-£3,000 per annum, plus cost of living adjustments (at present £36 p.a.) and will be subject to deductions under the State Superannuation Act. The commencing salary will be fixed according to the qualifications and experience of the successful appli-

cant. Under the Staff Members' Housing Scheme in cases approved by the University and its Bankers, married men may be assisted by loans to purchase a house. Applications, giving the names of three referees, should be forwarded to reach the undersigned, from whom further information may be obtained, not later than 25th March, 1961.

M. A. Telfer,
Registrar.

Sydney,
February, 1961.



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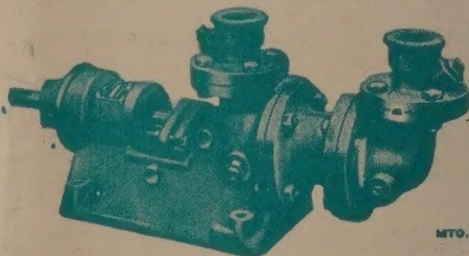
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